The

Tropical Agriculturist

July, 1928.

Editorial.

Extension of the Work of the Department of Agriculture.

BY Sessional Paper X. of 1928, the Government conveyed its decisions on the recommendations for the further extension of the work of the Department of Agriculture. These recommendations provide for the division of the Island into six agricultural divisions and propose to have in each such division a staff agricultural officer with a Central Agricultural Station and school and a number of subsidiary stations dealing with special problems of importance to the village agriculturists. It is really an attempt to provide for what is known in other countries as a technical extension service.

These proposals must take some time to elaborate but the majority of them have been begun. The agricultural station and school for the Southern Division has been acquired and is now in process of being laid out, while the buildings necessary for commencing agricultural classes are being constructed. In the North-Western Division some land has already been acquired at Wariyapola and further lands for extension are under acquisition. The erection of buildings at this station will take some time and it is unlikely that it will be possible to commence instruction of students at this station until the end of next year at the earliest. At each of these stations provision is being made for areas for paddy selection and for the multiplication of pure lines. Experience has shown in Ceylon that such selections cannot be made at a single central station, but it is thought possible to provide facilities at the divisional stations for this work and then to link such stations with the smaller paddy seed stations which have been established at various centres.

Provision is being made for two divisional stations—the one for the South-Western Division around Gampaha and the second for the Eastern Division. The opening of these stations must depend upon trained officers being available, and with the object

of filling these posts officers are now under special training in England and in Trinidad.

In the North-Western Division it is also decided to undertake investigations into the tobacco cultivation of that division with a view to ascertaining what improvements can be effected in the indigenous types of tobacco and whether introduced types such as White Burley and Adcock can be grown in that area.

Definite efforts are to be made to introduce an agricultural bias into education, and with this object in view handbooks for teachers have been prepared and are now under publication in English and the Vernaculars. These handbooks deal with the new subject Rural Science and with School Gardening. It is also proposed to translate into the Vernaculars certain standard elementary text-books on agricultural science, and a beginning has been made to improve the Sinhalese Agricultural Journal and to distribute it in larger numbers throughout the country. Free copies are being issued to co-operative societies, to schools and to village committees. In this manner it is hoped to awaken a greater interest in agricultural improvements and to disseminate the results of experiments and investigations carried out by the Department of Agriculture. It is also proposed that certain sections of annual reports—particularly those portions dealing with village agriculture—shall be translated into the Vernaculars and distributed among prominent and progressive village agriculturists.

Certain enquiries are to be made into manure supplies to village cultivators and into the marketing of produce. These enquiries are of great importance to small growers, and it is essential that improved facilities of marketing should be provided. Without such facilities, the small grower receives but a fraction of the value of his produce from the itinerating middle men and the experience gained in connection with the cotton and tobacco purchase schemes shows that improved organizations for marketing of produce are appreciated and are essential for the development of small holdings and for the expansion of new agricultural undertakings. Similarly it is desired to take steps to improve fruit cultivation and its marketing.

The whole object of the proposals is to assist the small grower by means of education, information and improved market facilities. The proposals will take some time before their effects will be fully visible, but with assistance and co-operation of those interested in rural development much should be possible. The proposals have been drawn up with the assistance of a committee of gentlemen interested in agricultural development and it is hoped that they may be adopted in their entirety without undue delay and that further co-operation and assistance from the general public will be forthcoming.

Original Articles.

A Yield Trial with Pure-Line Paddies at the Belunmahara Paddy Seed Station.

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and

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THE Belunmahara Paddy Seed Station is in the Low-Country of Ceylon and is situated about 15 miles from Colombo along the Colombo-Kandy Road. The paddy-fields in the district are mainly rain-fed but a precarious amount of irrigation water is available. In the vicinity of the Station the fields are cropped once a year during the north-east monsoon and a $5\frac{1}{2}$ to 6 months paddy—often heavily awned—is grown. The Station was opened in1926 and the first yield trial with pure-line paddies was laid down during the Maha (N.E.) season of 1926-27. As a result of that trial nine pure-lines were selected for a more elaborate trial during *Maha*, 1927-28. Long, narrow plots 6 ft. 6 in. by 33 ft. (=1/200 ac.) were used in the trial and each pure-line was replicated ten times. Each replication was in as compact a block as possible and the position of the plots in each replication was deliberately randomized.* This random arrangement is shown diagrammatically in Table I.

* See Fisher, R.A. Statistical Methods for Research Workers 1925.

Table I.

Showing Random Arrangement of Plots

(diagrammatic.)

a	b	c	d	e
I-17	G-3	W-15	I-17	i-10
Local	Local	i-10	i-10	a-12
G-3	k-7	E-24	a-12	E-24
i-10	C-14	I-17	b-13	k-7
b-13	I-17	a-12	W-15	W 15
W-15	a-12	k-7	k-7	G-3
k-7	b-13	G-3	C-14	Local
C-14	i-10	C-14	E-24	I-17
E-24	W-15	b-13	Local	C-14
a-12	E-24	Local	G-3	b-13

f	g	h	i	j
E-24	a-12	I-17	I-17	i-10
b-13	W-15	k-7	E-24	b-13
k-7	C-14	b-13	G-3	k-7
i-10	i-10	i-10	i-10	G-3
W-15	G-3	a-12	a-12	W-15
a-12	Local	Local	C-14	Local
G-3	b-13	W-15	Local	a-12
Local	k-7	G-3	b-13	I-17
I-17	E-24	E-24	k-7	C-14
C-14	I-17	C-14	W-15	E-24

Table II.

Yield of grain in quarter lbs. Belunmahara Trials, Maha 1927-28.

Selection or Variety.		Block a	b	c	d	e	f	g	h	i	j	Total.	Mean.
b-13	...	63	60	56	54	42	54	57	60	58	41	545	54·5
k-7	...	56	52	33	44	52	55	50	56	44	56	498	49·8
G-3	...	56	55	40	54	40	54	52	40	46	50	487	48·7
a-12	...	42	44	40	60	50	44	40	60	48	49	477	47·7
E-24	...	40	38	48	44	42	51	40	40	52	43	438	43·8
Local Paddy (Control)	...	52	40	36	33	40	40	36	44	37	41	399	39·9
I-17	...	38	50	42	46	36	32	36	40	40	32	392	39·2
C-14	...	50	36	41	24	28	40	33	36	48	40	376	37·6
W-15	...	39	32	36	28	32	39	36	42	38	32	354	35·4
i-10	...	30	28	28	35	28	33	32	34	28	36	312	31·2
Total	...	466	435	400	422	390	442	412	452	439	420	4278	42·78

The different paddies were sown on the 1st and 2nd August, 1927, and were harvested during January and February, 1928. Table II. gives the yields in quarter lbs. of each selection in the different replications. Using the methods of R. A. Fisher (*op. cit.*) the following results are obtained:—

Variance between	Degrees of Freedom	Sum of Squares	Mean Square	S. D.	Log S.D.
Blocks	9	496·96			
Varieties	9	4834·36	537·151	23·18	3·1432
Experimental Error	81	2993·84	36·956	6·08	1·8050
Total	99	8325·16			Diff. 1·3382

Whether an experiment is sufficiently accurate to differentiate between the yields of varieties depends on whether the variance derived from "varieties" is greater than the variance derived from "experimental error." If the variance due to varieties is significantly greater the experiment may be assumed to differentiate between the varieties tested and the more striking differences between them may be relied on as being a valid estimate of the true differences. The significance of the difference between the two variances is ascertained by the z test (see Fisher *op. cit.*) z is the difference between the natural logarithms of the corresponding standard deviations (or half the difference of the natural logarithms of the variances). In this experiment $z = 1{\cdot}3382$. With a probability of 0·05 (odds of 1 in 20) and for $n_1 = 8$ and $n_2 = 24$ $z = {\cdot}4283$. It is obvious therefore without interpolation that for $n_1 = 9$ and $n_2 = 81$ that a value for z of 1·3382 shows the difference between the two variances to be significant and, therefore, the more marked differences between the varieties tested to be reliable.

The results of the trial may be tabulated as follows:—

Selection	Varietal Extraction		Age at Flowering days	Age at Maturity days	Total Yield in lbs. 10 plots (i. e. 1/20 ac.)	Yield as a Percentage of the Control
b-13	Kurulutuduwi	...	140	139	136·25	136·5
k-7	Surasamba	...	137	173	124·50	124·8
G-3	Maha Mawi	...	138	191	121·75	122·05
a-12	Podiwi	...	140	188	119 25	119·5
E-24	Kalukanmawi	...	144	190	109·50	100 7
Local	Paddy (Suduwi)	...	124	166	99·75	100
I-17	Mawi	...	157	204	98·00	98·2
C-14	Kuru Mawi	...	144	198	94·00	94·2
W-15	Mawi	...	139	185	88·50	88·7
i-10	Puluksamba	...	140	188	78·00	78·2

There is strong evidence to regard the pure-line selections b-13, k-7, G-3, and probably a-12 also, as definitely higher yielders than the local paddy. The standard error of the difference between two selections is 6·55% which also indicates that the four top-yielders are significantly better than the local paddy. The increased yield of b-13 (36%) is very satisfactory and is larger than can normally be expected. The trials will be repeated during *Maha* 1928-29 with b-13, k-7, G-3, a-12 and certain other selections. It is interesting to note that the Divisional Agricultural Officer, Central Division, has found G-3 to head the trials at Mattamagoda and the Senior Agricultural Instructor, Ratnapura, has found G-3 to head the trials at Batugedera; b-13 is a very similar paddy to G-3 and has not yet been tested elsewhere. If its superiority over G-3 is maintained at Belunmahara and proved at other Stations it will be suitable for growing in a very large area. The grain of b-13 is larger than the grain of G-3. The respective measurements are given below:—

Variety		Paddy		Rice	
		Length m.m.	Breadth m m.	Length m.m.	Breadth m.m.
b-13	...	7·34	3·225	5·53	2·735
G-3	...	7·015	3·08	4·985	2·60

As the villager prefers a large, bold grain b-13 has an additional advantage over G-3.

Chemical Notes.

Manurial Values of Dadaps and Gliricidia Leaves, Stems and Branches.

AS frequent inquiries are made regarding the manurial values of Dadaps and Gliricidia leaves and stems, analyses were made in this laboratory by Mr. Kandiah, Asst. in Agricultural Chemistry, of tender leaves and stems and older branches of these widely-grown green manure trees.

The results are quoted below. It has to be emphasised however, that the results of analyses would vary with the different samples analysed, but these shown below may be considered as giving a fairly correct estimate of the manurial values of any sample of these green manure materials, at least so far as the nitrogen and mineral constituents are concerned.

On Fresh Material.

Percentages.

	Moisture.	Organic Matter.	Nitrogen.	Ash.	Lime.	Potash.	Phosphoric Acid.
Dadaps (leaves and tender stems) ...	69·8	28·4	1·09	1·84	·58	·34	·14
Dadaps (older stems and branches) ...	70·3	28·6	·32	1·07	·25	·24	·07
Gliricidia (leaves and tender stems) ...	73·1	24·3	·79	2·58	·77	·37	·19
Gliricidia (older stems and branches) ...	71·8	28·3	·39	·88	·20	·19	·07

On Material at 100°C.

Percentages.

	Organic Matter.	Nitrogen.	Ash.	Lime.	Potash.	Phosphoric Acid.
Dadaps (leaves and tender stems) ...	93·9	3·62	6·1	1·91	1·13	·46
Dadaps (older stems and branches) ...	96·4	1·08	3·6	·83	·92	·24
Gliricidia (leaves and tender stems) ...	90·4	2·95	9·6	2·88	1·37	·71
Gliricidia (older stems and branches) ...	96·9	1·40	3·1	·72	·66	·25

A glance at the table would show that while the nitrogen content of the Dadap leaves and tender stems is greater than that of the Gliricidia sample, the percentages of mineral constituents are higher in the latter. In the older stems and branches the reverse is the case, Dadaps branches having lesser nitrogen, and slightly more of the ash constituents. As is to be expected, Dadaps and Gliricidia leaves and tender stems have much higher nitrogen contents than the older branches, but the manurial values of the latter cannot be entirely disregarded. The organic matter contents of the older branches are slightly higher than those of the leaves and tender stems, but as the former are more woody and fibrous, and contain high percentages of lignin, they will be decomposed in the soil much more slowly than the latter and a part of them not at all. The chief fertilising constituents of the ash of the leaves and stems of both species of green manures are lime and potash. The table below shows the amounts of fertilising constituents in a ton of each of the different green materials.

	Organic Matter.	Nitrogen.	Lime	Potash.	Phosphoric Acid.
	lb.	lb.	lb.	lb.	lb.
Dadaps (leaves and tender stems) ...	636	24·4	13·0	7·6	3·1
Dadaps (older stems and branches) ...	641	7·2	5·6	5·4	1·5
Gliricidia (leaves and tender stems) ...	544	17·7	17·3	8·3	4·3
Gliricidia (older stems and branches) ...	634	8·7	4·5	4·3	1·5

The average weights of green material obtained per acre from Gliricidia and Dadap trees in tea are about 12 and 8 tons respectively. On this basis, it will be realised that the quantities of plant food and organic matter added by these green manures to an acre of soil yearly are considerable, and except for phosphoric acid, in excess of what is generally added to the tea each year in manure mixtures.

A. W.. R. J.

The Imperial Agricultural Research Conference, 1927.

Report by

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I HAVE the honour to submit, for the information of Government, the following abbreviated report upon the Imperial Agricultural Research Conference which was held in England during October and November, 1927.

2. As the Conference was to be held during my period of vacation leave in England, I was informed by the Director of Agriculture's letter No. P-224 of 21st June, 1927, that Government desired that I should attend the Conference as one of the Ceylon delegates and that I should devote my attention particularly to questions of an entomological nature which might arise during the course of the Conference. The other Ceylon delegates were Mr. R. A. Taylor, representing the Ceylon Rubber Research Scheme, and Mr. M. Crawford representing the Government Veterinary Department.

3. The Conference was opened in the Grand Committee Room in Westminster Hall, Houses of Parliament, by the Rt. Hon. Walter Guinness, Minister for Agriculture and Fisheries, on October 4th, 1927. All subsequent full sessions of the Conference were held in the same hall.

4. The Rt. Hon. Lord Bledisloe, Parliamentary Secretary to the Ministry of Agriculture and Fisheries, was appointed Chairman of the Conference and the Rt. Hon. W. G. Ormsby-Gore, M.P., Lord Lovat, and Major Elliot, M.P., Vice-chairmen.

5. A programme had been prepared allowing for meetings of the whole Conference from October 4th to 7th in London, of Administrative and Specialist Commissions from the 8th to the 13th October, visits of the whole Conference to Cambridge from 14th to 19th October, Edinburgh and Aberdeen from the 20th to 22nd October, (inspecting the synthetic nitrogen works at Billingham *en route*), and Belfast from the 22nd to 23rd October, and meetings of the Administrative and Specialist Commissions in London from 25th to 26th followed by plenary sessions in London

until October 28th. Subsequently an extensive tour of visits to Research Institutes was provided for between October 29th and November 8th. These institutes are referred to in appendix 1 of this report, those visited by the writer being at Cambridge, Rothamsted, East Malling Research Station, the Parasite Laboratory at Farnham Royal, the Long Ashton Fruit Research Station, Bristol, and the South Eastern Agricultural College, Wye.

6. **Agenda.**—The subjects on the agenda were classified into two groups, administrative and technical,—those under the former heading being:—

(1) The Recruitment, Training and Interchange of workers. (Chairman Mr. F. L. Engledow).

(2) The Establishment of a Chain of Research Stations. (Chairman, Major W. Elliot, M.P.).

(3) The Establishment of further Imperial Bureaux; and the Interchange of Information. (Chairman, Sir R. Greig).

(4) Periodical Conferences. (Chairman, Sir R. Greig).

7. The Conference opened with a general discussion on these subjects and it was decided that they should be dealt with in further detail by the Administrative Commission, which itself was subdivided into three committees, subjects (3) and (4) being considered by one committee.

8. A number of questions of a technical nature had been submitted to the Conference and for convenience they were classified under the following headings for the consideration of the Specialist Commissions.

Animals.

(1) Veterinary Science (Chairman: Sir A. Theiler).
(2) Animal Nutrition (Chairman: Professor T. B. Wood).
(3) Animal Genetics (Chairman: Dr. F. A. E. Crew).
(4) Dairying (Chairman: Dr. S. S. Cameron).

Soils and Fertilizers.

(5) Soils and Fertilizers (Chairman: Sir John Russell).

Plants.

(6) Plant Pathology, (including Mycology) (Chairman: Sir D. Brain).
(7) Plant Breeding (Chairman: Professor A. E. V. Richardson).
(8) Fruit (Chairman: Mr. W. T. Macoun).

Entomology.

(9) Entomology (Chairman: Dr. G. A. K. Marshall).

Economics.

(10) Agricultural Economics, (including Marketing) (Chairman: Mr. C. S. Orwin).

(11) Preservation and Transport (Chairman: Mr. H. T. Tizard).

9. According to this arrangement the delegates to the Conference were divided up, according to their particular interests, into a number of committees, the writer joining the entomology committee. After a full consideration of the various subjects referred to, the recommendations of the several committees were submitted to the full Conference at its concluding sessions, and the following is a very brief summary of these recommendations as finally approved.

Administrative Subjects.

The Recruitment, Training and Interchange of Workers.

10. The importance of agriculture demands that the Colonial Agricultural Service should attract men of the highest class and to affect this, emoluments and facilities for work should be adequate. The specialist officer should have received an honours training in the pure sciences, which should include at least one biological subject, and should possess such a knowledge of agriculture as would enable him to apply his scientific knowledge to agricultural problems. The general, or administrative, agricultural officer should possess wide agricultural knowledge and administrative ability with sufficient scientific knowledge to make full use of scientific discoveries in agriculture.

11. The report of this committee contains much information as to the course of training which agricultural officers should undergo before taking up their appointments under the Colonial Office and it is hoped that agricultural and other industries will assist by the foundation of scholarships for agricultural students. The existing scheme of scholarships under the direction of the Colonial Office is expected to meet immediate requirements and it is suggested that it should be extended to cover veterinary science. It would assist those responsible for the training of candidates for the agricultural services if Colonial agricultural departments would anticipate their staff requirements. The importance of study leave was emphasized and the present facilities in this direction were considered to be inadequate. The value of interchange between agricultural departments of certain members of their staffs was pointed out and further financial assistance is required to effect this very desirable aid to Imperial agriculture.

The Establishment of a Chain of Research Stations.

12. The principle of establishing central tropical and sub-tropical research stations was approved and it was made clear that they should be situated only in those parts of the Empire where they could most usefully fulfil the need for research into definite problems requiring solution. The location of the various research stations will be considered by the proposed Colonial Agricultural Research Council in consultation with the Colonial Governments concerned but it has been suggested that Peradeniya might prove to be a suitable centre for a station to serve the Middle Eastern Colonies, although the rival claims of Malaya have also been put forward.

13. The urgent necessity for the early establishment of a central station solely for investigation into the diseases of animals was brought to the notice of the Conference and it was suggested, in order to meet this immediate need, that the expansion of the existing station at Onderstepoort in South Africa should be proceeded with. Similarly the need for a station devoted to irrigation problems was indicated and reference was made to the research work on such problems which is already in progress in the Sudan and the Punjab. The work of the proposed stations should not in any way interfere with that normally performed by Government agricultural departments in their proximity. The work of a central station should proceed in the direction of free research and the controlling body should be such that there should be no possibility of this programme being interfered with. Teaching should not ordinarily be undertaken by the stations but a limited number of post-graduate students might receive instruction. It was suggested that the minimum staff of a central station should be ten well trained men. Apart from the capital expenditure of establishing a central station its upkeep might be expected to amount to about £20,000 per annum and the establishment of a particular station should not be proceeded with until a suitable staff and sufficient funds are forthcoming.

The Establishment of Further Imperial Bureaux, the Interchange of Information and Periodical Conferences.

14. The creation of three additional bureaux, similar to the existing Imperial Bureaux of Entomology and Mycology, was recommended for soil science, animal health, and animal nutrition. With regard to certain other sciences it was considered that their immediate requirements could be met by the establishment of " correspondence centres " and the sciences so

provided for are animal and plant genetics, agricultural parasitology, and fruit production. The suggestion that existing and proposed bureaux and correspondence centres should be incorporated in a single publicity bureau for the whole Empire and that a central clearing station, for subjects not covered by such bureaux and correspondence centres, should be established did not receive the support of the Conference; but it was suggested that the useful work already being performed by the Royal Botanic Gardens, Kew, in reference to economic botany and by the Imperial Institute in connection with the same and other subjects should be continued. It was estimated that a sum of £20,000 per annum, granted for five years in the first place, should be sufficient to meet the expenditure of the proposed bureaux and correspondence centres.

15. The value of periodical conferences of research workers was recognised and it was agreed that the next Conference should be held in Australia in 1932. The desirability of convening periodical specialist and regional conferences was also emphasized but it was considered that this was a matter which might be left to those to whom such conferences would be of special benefit.

Specialist Subjects.

Animals.

16. As the following four subjects will probably be dealt with in detail by the veterinary delegate from Ceylon, they are only very briefly referred to here.

17. **Veterinary Science.**—The difficulties under which Colonial veterinarians have worked in the past, owing to the lack of a central organization, were brought to the notice of the Conference and to remedy this defect a case was put forward for the formation of an Imperial Bureau of Animal Health. This proposal received the approval of the Conference.

18. **Animal Nutrition.**—The need for the establishment of a Bureau of Animal Nutrition was emphasized and was supported by the Conference. It was suggested that the bureau should, for the present, be located at the Rowett Institute, Aberdeen.

19. **Animal Genetics.**—The necessity for further research into this subject was pointed out. Veterinary officers should receive special training in the principles of genetics and the Animal Breeding Research Department of Edinburgh University is suggested as the centre for such training.

20. **Dairying.**—The subjects of nutrition, breeding and the physiology of milk production require further investigation. An interchange of dairy research workers would be beneficial.

Soils and Fertilisers.

21. The suggestion that an Imperial Bureau of Soil Science should be created was approved by the Conference and the manner in which such a bureau could best serve overseas workers was outlined. Subjects which received special attention by this committee were soil classification, methods of a mechanical analysis of soils, fertiliser trials and soil deterioration resulting from shifting cultivation and disafforestation.

Plants.

22. **Plant Pathology** (including mycology.—It was suggested that lists of plant diseases should be compiled by the Governments of the Empire for publication and distribution by the Imperial Bureau of Mycology. Other recommendations made by this committee were, that lists of books and periodicals, suitable for the use of Government mycologists, and of the institutions which should receive Government publications on mycology should be prepared. Attention was called to the preparation by the British Mycological Society of a list of scientific and common names of plant diseases. A further recommendation was that funds should be provided for the further inquiry into the nature of virus diseases of plants.

23. **Plant Breeding.**—The deliberations of this committee were devoted to the need for, and functions of, an information organization for the benefit of workers engaged in plant breeding problems. It was suggested that existing institutions might be made use of and that the Institute for Plant Breeding at Cambridge University might be utilised for tropical and sub-tropical crops and the Welsh Plant Breeding Station at Aberystwyth for work on herbage plants.

24. **Fruit.**—The questions related to this subject which are in need of urgent research are:—

(a) The study of stock and scion and their inter-relations.

(b) Surveys of fruit areas to determine the relation of various factors to tree growth and fruitfulness.

(c) Chemical studies relating to the tree and its crops.

(d) The associated physiological studies.

Other matters upon which research should be concentrated are transport and storage, preservation and by-products and the control of diseases and pests.

Entomology.

25. This committee very strongly recommended that at future Imperial Entomological Conferences the delegates selected to represent the entomological service of each Colony should

be entomologists. It was suggested that the quinquennial entomological conferences might with advantage be held in Imperial centres other than London. The establishment of travelling fellowships to enable entomologists to visit other parts of the Empire to study problems similar to their own was recommended. The importance of the biological control of insect pests was emphasized and the necessity for further research in this direction indicated. For this purpose further financial assistance might be provided for the parasite work of the Imperial Bureau of Entomology. Attention was called to the great importance of training in pure entomology as an essential basis for applied entomology.

Insecticides and Fungicides.

26. The committees of entomology, plant pathology and fruit held a joint meeting when the following resolution was passed:—

"That in view of the great importance of insecticides and fungicides in the control of diseases and pests, and in view of the very limited number of substances now available for this purpose, and of their relative inefficiency, this joint meeting of members of the entomology, plant pathology and fruit committees recommends that an investigation of the whole chemical field should be undertaken by chemists working in collaboration with entomologists and plant pathologists. For such an investigation, new appointments would be necessary, since existing workers are already fully occupied."

Economics.

27. **Agricultural Economics** (including marketing).—The importance of agricultural economics was pointed out and the scarcity of technically trained men referred to. More adequate agricultural statistics are required for various parts of the Empire and it was recommended that this deficiency should, wherever possible, be remedied.

28. **Preservation and Transport.**—The solution of fundamental problems connected with preservation and transport should not be left entirely to Great Britain as it has largely been in the past and all parts of the Empire should contribute to these investigations. Special problems requiring solution were mentioned.

Visits to Research Institutions.

29. The following is a very brief summary of the work in progress, and demonstrations witnessed, at the various research institutions visited by the writer:—

National Institute of Agricultural Botany, Cambridge.

(October 14th, 1927.)

30. The nature of the Institute's investigations was explained by Sir Daniel Hall, K.C.B. and the following exhibits were seen:—

(a) Models of diagrams to illustrate the Institute's organization and methods for the testing of the yielding capacity of varieties of farm crops under field conditions.

(b) Grain and sheaves of the chief cereal varieties tested in the past.

(c) The testing of agricultural, garden, and forest seeds for purity and germination.

(d) The examination of certain seeds for the presence of seed-borne diseases.

Department of Agriculture, Cambridge.

(October 15th, 1927.)

31. Professor T. B. Wood, F.R.S. described the activities of this Department after which visits were paid to the various branches and the following demonstrations witnessed:—

(1) **Calorimetry Department of the Animal Nutrition Institute** where research is carried on into the heat elimination of large animals, mainly pigs.

(2) **Poultry Section.**

(a) Digestibility experiments on oats, millets and maize.

(b) Slaughter experiments on Light Sussex fowls including complete analysis of the whole carcase.

(3) **Metabolism Room.**

(a) Investigations into the composition and nutritive values of pasture grass.

(b) Silage investigations.

(c) Influence of soaking and cooking of maize on its feeding value for pigs. Composition and feeding value of flaked maize.

(d) Grading, composition and feeding value of wheat offals.

(e) Chemistry of strength of wheat flour.

(f) Chemical changes occurring in wheat grain during growth and ripening.

(g) Composition and feeding value of sugar beet by-products.

(h) Proteins of blood serum, milk and colostrum.

(i) Protein and mineral metabolism in pregnant sows receiving normal and deficient rations.

(4) **Chemical Section.**—The work in progress in this section was explained to the delegates and several interesting demonstrations witnessed.

(5) **Plant Breeding Institute.**

(a) Genetic and cytological material of cereal crops.

(b) Demonstrations of baking quality in wheat.

(c) Plant breeding material in wheat, oats, barley, peas and beans.

(d) Data and material bearing upon the analysis of field crops.

(6) **Physiology Section of Animal Nutrition Institute.**

(a) Fertility of domestic animals.

1. Artificial insemination; life of spermatozoa.
2. Fertility of the male (stallions).
3. Foetal degeneration in pigs and rabbits.
4. Reproduction in the cow.

(b) Milk section.

1. Development of the udder in the cow.
2. Statistical investigations of milk records.

(c) Growth and meat problems.

1. Seedy-cut in bacon; spaying in pigs.
2. Growth and development of the pig.
3. Growth and development of the sheep for mutton.

(d) Factors affecting quality in wool.

(7) **Farm Economics Branch.**—The main activities of this section comprise economic investigations based on Cost Accounting.

(8) **Departmental Library.**

(9) **Soils and Soil Survey.**

(a) Soil temperature records.

(b) Decomposition of organic matter in alkaline and normal soils.

(c) Whittles' Apparatus of soil dispersion.

(d) Statistical crop maps.

School of Forestry, Cambridge.

(October 15th, 1927.)

32. The Museum of this Department contained a very complete collection of the timbers of the world, several Ceylon specimens being recognized.

University Farm, Cambridge.

(October 15th, 1927.)

33. During a tour of the farm the following sections were demonstrated:—

(a) Seed wheat cleaned and dressed for sale.
(b) Silage and silage crops.
(c) Baby beef cattle.
(d) Sugar beet demonstrations.
(e) Autumn cleaning of stubbles.
(f) Pig feeding.
(g) Grazing experiments.
(h) Fecundity experiments in pigs.
(i) Experiments in plant breeding.
(j) The dairy herd.

A demonstration was given of the control of bunt (*Tilletia tritica*) by:—

(a) The use of formalin, (wet).
(b) The use of copper sulphate, (wet)
(c) The use of copper carbonate, (dry)
(d) Resistant varieties.

The Potato Virus Research Station, Cambridge.

(October 15th, 1927.)

34. This station possessed a recently constructed insect-proof glasshouse for experiments in connection with the possible transmission of potato virus disease by certain insects. Particular attention was paid to the details of construction of this glasshouse and to the technique employed in this investigation in view of the supposed transmission by aphids of the Bunchy Top disease of plantains in Ceylon.

Bio-Chemical Laboratory, Cambridge.

(October 17th, 1927.)

35. The nature of the work in progress in this laboratory was explained by Professor Sir Gowland Hopkins, F.R.S. and is being directed to:—

(1) Mammalian bio-chemistry.
(2) Certain aspects of plant bio-chemistry.
(3) Nutritional studies such as the biological value of proteins and the properties of vitamins.

Molteno Institute of Parasitology, Cambridge.

(October 17th, 1927.)

36. Professor G. H. F. Nuttall, F.R.S. gave an account of the work of this Institute. A very complete and well displayed collection of the parasites affecting man and domesticated animals was on view.

The Low Temperature Research Station, Cambridge.

(October 17th, 1927.)

37. The work of this laboratory is devoted to ascertaining the effect of temperature on fruit, meat, eggs, and fish.

Department of Zoology, Cambridge.

(October 17th, 1927.)

38. An interesting display illustrating the activities of this Department had been prepared. Of special interest to the writer was the exhibit on British crop pests.

Rothamsted Experiment Station, Harpenden.

(October 27th, 1927.)

39. On arrival an outline of the work in progress at this station was given by Sir John Russell, F.R.S. after which the following departments were inspected and the work in each department explained in greater detail:—

(1) **Bacteriology Department.**—The main work of this Department relates to the study of the nodule organism *Bacillus radicicola* in connection with the inoculation of Lucerne seed and the changes in bacterial numbers from day to day in field soils.

(2) **Botany Department.**—The chief investigations in progress deal with:—

(a) The action of copper sulphate and silicates upon plant growth.

(b) The physiological significance of boron in the nutrition of various plants.

(c) The action of various chemical substances upon the germination of seeds.

(d) The influence of fallowing upon the weed flora of Broadbalk field.

(e) The comparative effect of artificial fertilisers on meadow hay.

(3) **Chemistry Department.**—The subjects under investigation relate to nitrogen and carbon cycles, green manuring, chemical processes in the soil, soil reaction, phosphatic, nitrogenous and potassic fertilisers, barley investigations and the influence of certain manures on the yield and sugar content of sugar beet.

(4) **Fermentation Department.**—The work of this Department was confined chiefly to the investigation of synthetic farmyard manures and the purification of the effluents from beet-sugar factories.

(5) **General Microbiology Department.**—The investigations of this Department relate to a study of soil bacteria and protozoa and their effect on nitrogen fixation, ammonification and carbon hydrate decomposition in soils of various types. The effect of treating soil with steam or volatile antiseptics is also under investigation.

(6) **Insecticide and Fungicide Department.**—The insecticidal action of plant extracts and synthetic organic compounds both upon adult insects and their eggs is being tested. Investigations are also in hand regarding the insecticidal effect of stomach poisons and the tolerance of foliage to them. Experiments are in progress with the object of discovering new materials for the destruction of soil pests. Further investigations deal with the changes which sulphur undergoes in the soil under varying conditions. In view of the importance of this subject and the need, as expressed by a resolution of the Conference, for further exploring the chemical field in the hope that new and valuable insecticides and fungicides might be discovered, an undertaking was given that a number of wild Ceylon plants, which are known to possess toxic properties against fish will be collected and dispatched to Rothamsted for analysis and trial.

(7) **Soil Physics Department.**—The investigations of this Department relate chiefly to problems of soil tilth, the effect of clay and organic matter upon the soil particles, the colloidal property of the soil, and the relations between soil solution and the soil. The question of soil cultivation is receiving special attention.

(8) **Statistical Department.**—Enquiries are in progress to ascertain the effects of rainfall and temperature upon certain crops. Investigations regarding the relations between weather responses and manurial treatment have led to certain improvements in the design of field plot experiments, resulting in a considerable reduction of experimental error.

(9) **Entomology Department.**—The work of this Department deals with the reproduction and migration of Aphides a study of the control of insect pests by parasites, apicultural investigations, the control of weeds by insect enemies particularly that of Gorse (Ulex) in New Zealand, an enquiry into the Gall-midges attacking cereals and the seeding of meadow foxtail. The type of insectary in use at this station where insects are bred, as nearly as possible, under open air conditions was of special interest. Methods of breeding termites in capti-

vity were discussed with Dr. A. D. Imms of this Department, who has considerable experience of this type of work.

(10) **Mycology Department.**—The investigations in progress include:—

(a) A study of soil fungi and algae.

(b) The genetics of fungi.

(c) The relation of nutrition to parasitic disease in plants.

(d) The physiology of parasitism with special reference to fungal and bacterial diseases of tropical crops.

(e) The physiology and genetics of the Smut fungi.

(f) The nature and causes of Virus diseases of plants.

(g) Wart Disease of potatos.

(h) Fungicidal investigations.

East Malling Research Station.

(November 1st, 1927.)

40. An account of the work in progress at this station was given to delegates by the Director, Mr. R. G. Hatton, and was followed by a tour of the station and laboratories. During the tour of the station demonstrations on the following subjects were given:—

(a) Variation of horticulturist's material.

(b) Measure of control through rootstock.

(c) Incompatibility of stock and scion.

(d) Pruning in relation to purpose and variety.

(e) Manuring of fruit trees.

(f) Advantages of vegetative methods of propagation.

(1) **Physiology Laboratory.**—The following are the subjects engaging the attention of this laboratory:—

(a) Physiological classification of rootstocks.

(b) Analysis of influence of rootstock on scion.

1. Influence of stem as apart from root.
2. Distinction of quantitative from qualitative factors.
3. The blending of stock characters.

(c) Problems of vegetative propagation.

(d) Relation of secondary thickening to new shoot.

(2) **Mycology and Bacteriology Laboratory.**—The problems under investigation by the staff of this laboratory are:—

(a) Bacterial diseases of plum and cherry trees.

(b) Raspberry diseases.

(c) Crown-gall on nursery stocks.

(d) The effect of root stock on the susceptibility of the scion as illustrated by apple mildew and apple scab.

(e) The control of apple scab and mildew.

(f) The distribution of the Brown Rot fungi.

(3) **Entomology Laboratory.**—The entomological investigations at this station relate to the resistance of apple stocks to Woolly Aphis attack, the control of the Black Current Gall Mite, dormant winter wash trials, and the control of the Apple Blossom Weevil.

The Parasite Laboratory, Farnham Royal.

(November 3rd, 1927.)

41. This laboratory, which stands in six and a half acres of ground is situated near Slough and is maintained by the Imperial Bureau of Entomology. The conversion from a country residence into a laboratory has been skilfully done and the rooms have been well fitted with modern equipment. At present the staff consists of a Superintendent, two technical assistants in addition to a subordinate staff of laboratory assistants, gardeners and a mechanic. Two well constructed insectaries have been erected for the rearing of parasites, and a cold storage plant has been installed.

42. Work in progress, and contemplated, relates to parasites of the Codling Moth, the Lucerne Flea, the New Zealand Earwig, Woolly Aphis, and the Sheep Blow Fly. Several consignments of parasites have already been successfully shipped abroad. A very useful catalogue of the known parasites of world pests is being compiled and an undertaking was given to furnish a complete list of the parasites of common pests already known in Ceylon, many of which may not have been previously recorded. This list is already in preparation. The possibility of securing parasites for tea tortrix was discussed but there was no information available on this matter which would require independent investigation.

43. With the extension of this laboratory and an increase in staff, following further financial support, there can be little doubt that it will, in the future, prove a most valuable Imperial asset and is deserving of the support of every Colonial Government interested in agriculture.

Long Ashton Fruit Research Station, Bristol.

(November 4th, 1927.)

44. A tour of the laboratories and station was made and the work in progress explained in detail. The writer devoted most of this visit to a discussion with Mr. Swarbrick on the heal-

ing of woody stems a subject to which he has devoted a great deal of research. This is a matter which may be of importance in connection with the prevention of die-backs in recently pruned tea bushes, and consequently lead to a diminution in the very serious condition known as wood-rot or "canker."

The South-Eastern Agricultural College, Wye.

(November 7th, 1927.)

45. An account of the courses of instruction was given by Mr. Wilson the Principal, and visits to the laboratories and farm were made.

Appendix I.

Research Institutions to which visits by delegates to the Conference had been arranged.

Cambridge.

National Institute of Agricultural Botany.

Department of Agriculture.

School of Forestry.

University Farm and Potato Virus Research Station.

Bio-Chemical Laboratory.

Molteno Institute of Parasitology.

Low Temperature Research Institute.

Balfour Institute of Genetics.

Department of Zoology.

Institute of Animal Pathology.

Edinburgh.

Animal Breeding Research Department, Edinburgh University.

Royal (Dick) Veterinary College.

Animal Diseases Research Station.

Plant Breeding Station and Plant Registration Station. (Corstorphine).

Aberdeen.

Rowett Institute.

Craibstone.

Belfast.

Gracey Bros.' Cold Store.
Hilhall, Lisburn. (Poultry fattening).
Plant Breeding Station. (Stormont).
Poultry Station. (Stormont).
Animal Diseases Research Station. (Stormont).
Linen Research Institute. (Lambeg).

Other Centres.

The Rothamsted Experiment Station.
Imperial College of Science and Technology. (London).
Royal Botanic Gardens, Kew.
Oxford University.
East Malling Research Station.
Royal Veterinary College, Camden Town, N.W.
Institute of Agricultural Parasitology, St. Albans.
Ministry of Agriculture and Fisheries, Veterinary Laboratory, New Haw, Weybridge.
Royal Horticultural Society's Gardens, Wisley, Surrey.
Glasshouse Crops Station, Cheshunt, Herts.
Long Ashton Fruit Research Station, Bristol.
National Institute for Research in Dairying, Shinfield, Nr. Reading.
Welsh Plant Breeding Station, University College of Wales, Aberystwyth.
Agricultural Department of the University College of N. Wales, Bangor. (Soil Surveys).
South Eastern Agricultural College, Wye, Kent.
The Parasite Laboratory of the Bureau of Entomology at Farnham Royal, near Slough.
Forest Products Research Laboratory at Princes Risborough, Bucks.
British Research Association for the Woollen and Worsted Industries, Leeds.
John Innes Horticultural Institution, Merton Park, Surrey.
Imperial Institute, London.

Appendix II.

Papers submitted to the Conference from Ceylon:—

By the Director of Agriculture.

1. Memorandum on Agricultural Organisation and its work in Ceylon.
2. Memorandum on Agricultural Research Work in hand at present in Ceylon.
3. The establishment of a Bureau of soil and Agricultural Chemistry.
4. The Co-ordination of General Agriculture and Agronomy in the Tropics.
5. Provision for Specialists to visit other Colonies and Protectorates.
6. The effect of Grasses and other Plants (e.g., Leguminous Cover Crops) on Permament Tropical Crops.
7. Soil Erosion.
8. "Shifting" Cultivation.

By the Government Veterinary Surgeon.

1. Memorandum on Work of the Veterinary Department, Ceylon.
2. Economic Aspects Regarding the Place of Live Stock in Tropical Agriculture.

Contribution from the
Rubber Research Scheme.

Imperial Agricultural Conference.

Report by

R. A. TAYLOR, B.Sc.,

Physiological Botanist, Ceylon Rubber Rese arch Scheme.

THE writer was privileged to attend the first Imperial Agricultural Conference held in London during October and November, 1927. The following short article does not purport to be a report of the proceedings of this Conference but merely a few notes on points raised during discussions and work actually seen in progress on certain of the Experiment Stations visited which would appear to have some bearing on the Plantation Rubber Industry.

The writer attended the meetings of the Soils Committee and by so doing missed meetings of Committees on Plant Pathology and Plant Breeding, but it was thought that the former would prove more productive of information likely to be of value to Rubber Growers in Ceylon. A large part of this paper therefore will deal with soils and the discussions held on that subject.

During the itinerary arranged for delegates by the Empire Marketing Board the stations of Rothamsted and East Malling among many others were visited and these visits will be mentioned in connection with points of interest which arose. Although not a member of the Committee which discussed Agricultural Economics the writer collected a certain amount of information on the subject which may be of value to estates especially during periods of depression where strictly economical working is essential.

Soils and Fertilizers.—The subject matter of the discussions was as follows:—

(1) Functions of a Soil Bureau.
(2) Soil surveys; unification of methods,—Laterite soils.
(3) Fertilizer trials; possibility of obtaining some degree of uniformity in the principles underlying.

(4) Shifting Cultivation; the means of avoiding it and the means of maintaining fertility. This item to include Soil Deterioration, Green manuring, Use of Artificial Fertilizers and the Utilisation of waste Cellulosic Materials.

It is unnecessary to enlarge on the importance of the study of soils especially in Ceylon where in many districts the same soils have borne in turn crops such as Coffee, Tea and Rubber. It is now I think realized that many serious mistakes in soil management have been made in the past, witness the washed out condition and lack of organic content of the soil in most of the rubber planting districts; and the belated rush to grow cover crops. The study of soils is still really in its infancy although the past decade has witnessed very great changes in our conception of soils.

Work is now being carried out in every country with an Agricultural industry and what is most needed now is co-operation amongst those workers so that progress may not be impeded by unnecessary repetition of work or lack of knowledge of suitable methods of procedure. The general opinion of the Soils Committee at the Imperial Agricultural Conference was that the first need was the establishment of a centre for the distribution of information. This was considered to be one of the chief functions of any Bureau established. Isolated workers have not always facilities for examining work previously done elsewhere on problems closely resembling those which they have in hand, also, methods are being continually improved and changed and results are much more easily compared and of much more value when the same method of investigation has been adopted. A Soil Bureau therefore should have as complete a library as possible on soil science and should collaborate with all soil workers in the Empire to keep it complete and should be able to render assistance. By some such system methods would gradually become standardised and the results obtained more easily compared *inter se*. The establishment of such an Information Centre would of course mean the collection of a competent staff. The above was considered to be the branch of the work which should have immediate attention.

Among other lines of work which were set down was the organization of soil surveys in the Empire, and here help was to be given to individual workers or institutions by (a) the working out of methods for use in field and laboratory, (b) identification of soil minerals and furnishing of complete mineralogical and chemical analyses, (c) the development of new work and assistance in co-ordination of existing surveys, (d) formation of a collection of the principal soil types of the Empire; publication of results. Also the Bureau should be available for the supply of advice and assistance in the organization of experimental work

on the maintenance and increase of soil fertility by cultivation, fertilizers, irrigation and other means, and the arrangement of visits from its specialist officers to the colonies and general interchange of workers. The organization of Specialist Conferences would also come within the scope of such a Bureau.

It was decided that Rothamsted would be the best location for the Bureau as its functions could only be carried out in close association with an institute dealing with soil problems. There is also a comprehensive library there and a staff of experts already engaged on the various aspects of soil study.

The Committee dealt with the other subjects enumerated above and it was decided that recognized leading workers should present memoranda on the following subjects to the Bureau to enable standardisation of methods to be effected and suggestions for experimental work to be made.

(1) Soil classification.

(2) Methods of Mechanical Analysis of soils.

Here the following resolution was passed.

" It is desirable that, where soil survey data are to be published the mechanical analysis should be made by the International method or by some other method which has been shown to give the same results, it being recognized that certain soil types such as laterites and highly calcareous soils require special methods."

(3) Fertilizer Trials.

(4) Soil Deterioration; resulting from shifting cultivation. Deafforestation, etc.

In connection with Fertilizer trials discussion showed that differences in crops and conditions made it impossible to lay down any detailed scheme which would be applicable over all. As a basis of discussion the Rules drawn up by the International Commission for the study of chemical Fertilizers were used and as these may prove interesting they are given below:—

(1) **Soil.**—Choose a soil as uniform as possible, and test it by a sufficient number of borings, arable layer down to.....cm. sub-soil..... Avoid ground with a steep slope, especially in not very permeable soil. If sloping ground has to be used, mark out rectangular plots elongated at right angles to the run of the valley.

(2) **Shape of the plots.**—Be guided by the possibilities of the ground and other local conditions for marking out square or rectangular plots.

(3) **Area of the plots.**—Give each plot a minimum area of 25 sq.m. and a maximum of 100 sq.m.

(4) **Number of plots.**—Repeat the same test at least 5 times and have at least 5 control plots.

(5) **Distribution of the plots.**—Distribute them uniformly according to the dimensions and lie of the ground.

(6) **Paths between the plots.**—The plots should be contiguous except for leaving a path in a single direction 50 cm. wide between every second plot to facilitate cultural operations and inspection, seeding to cover uniformly the whole surface of the plot. For the harvest, plants to a width of 50 cm. inside the boundaries of each plot are first of all removed. The experiments are therefore always separated from each other by a distance of 1 metre on 3 sides and by 1 m. 50 on the side of the patch.

(6a) **Distribution of the fertilizers.**—The fertilizers should be applied accurately and regularly, special attention being given to the application of farm-yard manure. Each fertilizer should be applied at the most suitable time to have good effect, in one or several applications.

(7) **Duration of the tests.**—Continue the testing of the same areas during at least 5 years on successive crops.

(8) **Characteristics of the soil and climate.**—Note them and publish them with the results:—*Soil*, locality, depth, analysis (methods of the International Association of Soil Science, and for dry climates repeated determinations of the humidity of the soil). *Climate*, temperature, nebulosity, rainfall—quantity and number of days,—snow—actinometry.

(8a) **Composition of the fertilizers.**—Always give precise indications of the fertilizers used:—Nature, origin, fineness, complete chemical analysis and finally petrographic or microbiological characters.

(9) **Plants used.**—Always use well-tested seeds, indicate their quality the density of sowing. State very precisely the variety and origin.

(10) **Remarks on growth.**—Note the essential facts of growth, their dates, attacks of diseases or of parasites. Weeds, Treatment applied. Casualties or damage caused by meteorological factors or fortuitous.

(11) **Crop.**—It is recommended that the results should always be expressed in air-dried matter and in dry substance.

(11a) **Experimental error.**—The experiment will be considered as demonstrative when the differences of the average results obtained are less than double the probable error.

(11b) **Experimental Farms.**—The commission considered it advisable to establish an experimental farm in each natural region subject to the direct control of laboratories of the different departments co-operating in the improvement of agriculture.

As already suggested only the basic rules are applicable to all crops. With rubber rule 1 is applicable. Rule 2 is also to a certain extent applicable but here, if accurate results are to be obtained, it will be necessary to arrange the plots so that the personal factor of the skill of the tapper can be eliminated. No. 3 does not apply; No. 4 does. Rules 5, 6a, 7, 8, 8a, 10, 11, 11a. apply generally. Rule 6 obviously does not apply with a tree crop. Rule 9 will not apply as a general rule as manuring trials are usually carried out on blocks of old rubber, the object being to see whether these can be improved and made more productive. This rule would apply if botanically uniform material were used for planting up and manuring started immediately after planting.

At Rothamsted the work actually in progress at the time was seen. This was all intimately concerned with soils.

In the Bacteriology Department work was being conducted on the inoculation of Lucerne seed with cultures of the nodule organism, Bacillus radicicola. Besides the laboratory and greenhouse work, field trials at 50 centres were in progress. The life history of the organism and the relation of the plant to the formation of nodules are being studied as well as the changes from day to day in the number of bacteria present in field soil. The Botany Department has in hand the study of the actions of various chemicals such as copper sulphate and silicates upon plant growth, and an investigation into the physiological significance of boron in the nutrition of plants. Here also a study of the controlling of weeds is being made and manuring trials on meadow hay are in progress.

It is impossible in a paper of this nature to give any real indication of the number of investigations in hand in the Chemistry Department, and a list of the subjects under study only will be given.

Soils and Fertilizers.

(a) Nitrogen and Carbon Cycles.
(b) Green manuring.
(c) Chemical processes in the Soil.
(d) Soil reaction.
(e) Phosphatic fertilizers.
(f) Superphosphate.
(g) Nitrogenous fertilizers.
(h) Potassic fertilizers.

Crops.

(a) Barley investigations.
(b) Sugar beet.

Fermentation Department.—The work here is concerned with the converting of straw and other cellulosic materials into Synthetic Farmyard Manures, and especially the action of fungi, as distinct from bacteria, in the breaking down of cellulosic matter.

Another branch of the work is the study of methods of purification of the effluents from Beet Sugar Factories which are polluting the rivers. In the *General Microbiology Department* the following are the subjects under investigation.

(a) Reproductive rates of various Protozoa in the soil.

(b) The conditions which cause the Cystic physiological condition in Protozoa.

(c) Study of life histories and physiology of protozoa.

(d) Effect of sterilisation of soil.

(e) Effect of pure cultures of protozoa and bacteria, on nitrogen fixation, ammonification and carbohydrate decomposition in various soils and under different conditions.

Insecticide and Fungicide Department.

(1) Study of insecticidal action of plant extracts in all its aspects.

(2) Study of the changes which sulphur undergoes in the soil. This has arisen from the very variable effect of finely divided sulphur thoroughly mixed with the soil on the wart disease organism.

Soil Physics Department.—The properties of the soil that are studied in this department can be broadly divided into two groups dealing respectively with the soil particles themselves, and their relations to the soil water. The first group embraces problems of soil tilth, the effect of clay and organic matter, and the colloidal properties of the soil.

The second group includes studies of the complex relations between the soil-solution and the soil, especially those that bear on problems of soil acidity.

Considerable work is being done on soil cultivation, and in particular on the resistance offered by a soil to the passage of a plough, and laboratory methods have been devised to study the soil properties concerned. Dynamometer records of drawbar pull obtained in the field are in effect the integration of these soil properties, and form a sensitive measure of the variation of soil characteristics. The results show a large degree of significant variation even on areas apparently uniform to visual inspection. The drawbar pull is closely correlated with soil properties such as drainage and also with plant growth. The latter aspect is being closely followed up in view of its importance in modern experimental plot technique.

The meteorological section of the department has been considerably extended by the installation of self-recording devices. Work in progress includes a study of soil temperature fluctuations, and the relation between rainfall and drainage.

Statistical Department.—Two meteorological enquiries are in progress, both extensions of the previous work in which the effects of rainfall at all seasons of the year upon the wheat crop, were calculated. A parallel study is now being made upon the responses of barley under different manurial treatments to rain; the importance of temperature records, especially in relation to horticultural crops, has led to a comprehensive statistical study of the Rothamsted records.

In view of the intimate relations between weather responses and manurial treatment (and also between weather response and variety), efforts have been made to improve the design of field plot experiments up to a level of accuracy at which they will begin to throw light on these problems. Such improvement is for all purposes a standing need. It is now possible to lay down definite rules under which results of known accuracy may be obtained from admittedly heterogenous soil; and it has been shown from the study of uniformity trials, that in such systems of experimentation, the errors may be reduced, if necessary, within one per cent.

Institute of Plant Pathology.

Entomology Department.

(1) A study of the chief factors governing the reproduction and migration of Aphides with special reference to the Bean Aphis and the Hop-Damson Aphis.

(2) Rearing and investigation of parasites with special reference to their influence in controlling injurious insects.

(3) Apicultural investigations. A study of some immediate practical problems of apiculture, and of the changes in temperature, moisture, and carbon dioxide inside the hive.

(4) The biological control of certain noxious weeds by means of their insect enemies (in conjunction with the Cawthron Institute, New Zealand).

(5) Gall-midges affecting cereals and the seeding of meadow foxtail.

Mycology Department.—The investigations in progress include:—

(1) The soil fungi and algae; their kinds, numbers, distribution and activities in the soil.

(2) The genetics of fungi; morphological and physiological strains and the scope and nature of genetic and other changes of fungi in culture and on the living plant; the relation of such changes to disease.
(3) The relation of nutrition to parasitic disease in plants.
(4) The physiology of parasitism with special reference to fungal and bacterial diseases of tropical crops.
(5) The physiology and genetics of the Smut fungi with particular reference to diseases of cereal crops.
(6) The nature and causes of Virus diseases of plants.
(7) Wart disease of potatos; (a) the nature of immunity; (b) method of testing immunity or susceptibility.
(8) Fungicidal investigations; substances toxic to Synchytrium endobioticum.

Field Experiments.—The variations in yield of field crops due to manurial, seasonal and soil factors are studied by quantitative plot observations on the growth of the crop throughout the season. In the laboratory the analysis is carried further and detailed measurements are made on samples chosen from the field plots.

These measurements furnish data for the investigation of such fundamental physiological processes as rates of growth, net assimilation, uptake of nutrients and maturation of the grain

The above is partly copied from a leaflet issued to delegates of the Conference and shows the very varied nature of soil studies. That Rothamsted is the most suitable situation for the proposed Bureau of soils cannot well be doubted.

East Malling Research Station.

The work here is not so intimately concerned with soil study although the latter can never be quite absent during Agricultural research. The subjects under investigation here which are of special interest and significance to Rubber growers are as follows:—

(a) Budding and grafting.
(b) Variation in stocks.
(c) Methods of overcoming this; vegetative propagation.
(d) Effect of stock on scion.
(e) Field recording.

On (a) I need not comment; we have a satisfactory method of budding. The variation in material, particularly stocks, in fruit growing is however a very important matter where large clones of a permanent crop are being raised. Seedling stocks have been proved to be very variable while vegetatively raised

stocks are more or less uniform. The variation between individuals in two clones of apples where vegetatively raised stocks were used was exactly half that found on seedling stocks. It has also been found that a large measure of control over the tree obtainable can be exercised by judicious choice of rootstocks. Rootstocks affect:—(a) Size of tree, (b) Rate of growth, (c) Early or late fruiting in fruit trees.

There seems no reason to assume that similar if not so great effects may not be brought about by the use of different varieties of stock in Rubber budding. There is a large difference between individuals in any of the present clones of budded rubber although this is certainly smaller than that found in a plantation of mixed seedlings. It seems very probable that this can be reduced still further by the raising of stocks vegetatively. Much work will however have to be done to find out which stocks are going to give rapidly maturing trees of high yield. A study of the mutual effect of stock and scion is essential before uniform blocks of high yielding trees can be obtained.

In certain cases at East Malling incompatibility of stock and scion has been found. Growth, although at first vigorous on certain stocks, later practically ceases and a weak union is obtained. This was found with Pears on certain quince stocks. A point of interest which may be mentioned here was the beneficial effect of potash manure as a preventive of "Leaf scorch." Potash is known to thicken the cuticle on leaves and is beneficial against certain leaf diseases of rubber.

Field Recording.—Records are made of the following for each tree.

1. Its height and spread.
2. Girth of the stem.
3. Length of new wood grown since previous season.
4. Number of fruits produced and the weight and perhaps colour.
5. Any particular manifestation such as prevalence of mildew; leaf scorch, scab, etc.

and occasionally

6. Fruit buds are counted.
7. Where pruning employed. Weight of prunings removed.
8. Occasional tree lifted, weighed and a thorough examination of root system made.

Some such thorough method of recording will be essential in connection with similar work undertaken with rubber.

Agricultural Economics.—This to many will appear to be a new science, and it is true that its real importance has been realised only during the past decade. The principal Colleges of Agriculture are now paying particular attention to this aspect

of the agricultural question. Until quite recently practically no farmers in Great Britain kept any books to show the state of their affairs and the result was that it was impossible for them to compare the value of their various crops as paying propositions. They could not tell what the cost of cultivation of a certain field had been and had no means of estimating the net return on outlay of their various fields.

The Economics Sections at Oxford and Cambridge are now carrying out detailed work of this nature on farms of various types, and already benefits have been derived. Farmers are enabled to say which is their best-paying crop and can reduce or omit from their rotation any which is grown at a loss on their particular farm.

This may seem rather remote from rubber growing but it is thought that a little consideration will show the connection. Here one crop only is grown and from earliest times estates have had to record all transactions in a business-like manner. In this way estates are ahead of the majority of home farmers, they can tell the actual cost of their various operations, Tapping, Weeding, Agricultural works, Disease work, Manufacture, etc., and can give accurate figures as to how the total cost of production of the pound of dry rubber is distributed amongst these various works. On different estates cost of production varies within wide limits, and this is not completely due to variation in yield between these estates. Very often one finds that a planter takes more interest in one of the many estate works than in the others. This he reduces to a fine art and takes pride in the fact that his cost of tapping or whatever it may be is lower per pound of dry rubber than that of any other estate around. This is all worthy of encouragement but it benefits only the one work on the one estate. Were someone to spend say six months going round rubber estates and examining costs of all the various works it is thought that some interesting and useful figures would be obtained. One estate would it is expected tap efficiently at a cheaper rate than any other, another would manufacture cheaper and so on. Further study and enquiry might quite possibly elucidate the reason for cheapness of these operations, probably it might be run down to more efficient organization in one case or more efficient machinery in the factory, in another special attention to minor details, or elimination of all sources of loss of crop, etc. Information of this description available to large firms would enable them to profit by ensuring that all works on all their estates were carried out in the most economical manner.

Much more might be said on the subject but it is thought the above is sufficient to indicate the desirability of holding an enquiry especially at the present time into the great variation seen in costs of production.

Report on the Effect of Different Dilutions of Latex and Strengths of Coagulant on the Plasticity, Vulcanising and Mechanical Properties of Rubber.

THE effect on the quality of rubber of coagulating latex with different amounts of acetic acid has been investigated on several occasions and the conclusion has been reached that the amount of acid used may be increased considerably beyond the minimum required for complete coagulation without adversely affecting the vulcanising and mechanical properties of the rubber. The reason for this is that acetic acid is a weak acid. If however an excess of a stronger acid (such as formic or sulphuric) is employed it is found that the rubber vulcanises more slowly than when the minimum amount is used, and in extreme cases the mechanical properties are adversely affected (see Investigations of the Ceylon Rubber Research Scheme.—Quality of Plantation Rubber p. 164). As formic acid has now largely replaced acetic acid and as some estates use sodium silicofluoride as a coagulant, the London Advisory Committee considered it of importance to determine the effect of different amounts of these coagulants with different dilutions of latex not only on the vulcanising and mechanical properties but also on the plasticity of the raw rubber. The matter was discussed with Mr. O'Brien while he was in England on leave and he undertook to prepare samples for investigation

Description.

Two sets of crepe were prepared from latex containing 15 and 30 per cent. dry rubber, using different amounts of acetic and formic acids and sodium silicofluoride. The latter being a relatively weak coagulant will not completely coagulate latex of 30% concentration. No samples were therefore prepared from 30 per cent. latex using sodium silicofluoride as a coagulant. Otherwise 1, 2, 4 and 6 times the minimum amount of each coagulant was used for both dilutions of latex, the minimum amounts being taken as:—

	15 per cent. latex.	30 per cent. latex.
Acetic acid	1:180 parts dry rubber.	1:250 parts dry rubber.
Formic acid	1:360 parts dry rubber.	1:500 parts dry rubber.
Sodium silicofluoride	1:200 parts dry rubber.	—

When acetic and formic acids were used 1 part of sodium bisulphite per 250 parts of rubber was added to the 30 per cent. latex and 1 part per 180 parts to the 15 per cent. latex.

The latex was obtained from the same group of trees on Culloden Old Division, the samples from 15 per cent. latex being prepared two days later than those from 30 per cent. latex. The morning following the addition of coagulant the samples were rolled to thin crepe by the usual procedure, i.e., five times through the grooved rollers and once through the smooth roller.

When four or six times the normal amount of acetic and formic acids was used, coagulation was very rapid and the latex thickened considerably before it was distributed to the coagulating dishes. Mr. O'Brien observes that in practice it is certain that these excessive amounts of acid would never be used except by mistake, owing to the inconvenience caused.

Results of Examination.

The samples were submitted to plasticity and vulcanisation tests at the Imperial Institute six months after preparation.

Plasticity Tests.

The following table summarises the results obtained in these tests:—

Sample No.	Dilution of latex (per cent)	Coagulant Nature	Quantity used	Time of Mastication (mins)	Raw Rubber D30 mm./100	Masticated Rubber D30 mms./100	Masticated Rubber Ev ccs.
1286	30	Acetic	Normal	24½	166	76	14·1
1287	,,	,,	2 x do.	23½	164	76	14·9
1288	,,	,,	4 x do.	23	163	73	14·2
1289	,,	,,	6 x do.	23½	159	79	14·9
1290	,,	Formic	Normal	23	172	77	11·9
1291	,,	,,	2 x do.	24½	166	76	13·1
1292	,,	,,	4 x do.	23½	163	76	14·2
1293	,,	,,	6 x do.	24	158	72	16·0
1294	15	Acetic	Normal	22½	153	72	11·5
1295	,,	,,	2 x do.	23	157	75	10·9
1296	,,	,,	4 x do.	23	152	78	11·0
1297	,,	,,	6 x do.	22½	159	78	9·9
1298	,,	Formic	Normal	22	157	76	11·1
1299	,,	,,	2 x do.	22	161	77	9·3
1300	,,	,,	4 x do.	22	151	73	10·7
1301	,,	,,	6 x do.	23½	145	70	11·0
1302	,,	Sodium	Normal	25	159	75	12·8
1303	,,	silico	2 x do.	23½	166	73	11·3
1304	,,	fluoride	4 x do.	23	163	73	14·8
1305	,,	,,	6 x do.	23½	154	74	14·3

The plasticity of the raw rubbers as indicated by the D30 values is fairly constant but the results of the tests on the samples from 30 per cent. latex indicate that increasing in strength of the coagulant increases the plasticity of the raw rubber. This however is not confirmed by the tests on the samples from 15 per cent. latex.

The samples were masticated until a fixed amount of power had been consumed. Under these conditions the time of mastication did not vary greatly.

In the case of the masticated rubber, only the formic acid samples from 30 per cent. latex give definite indications of the plasticity of the rubber increasing with the strength of the coagulant.

The plasticity of the rubber produced by the different coagulants from the same latex shows some variation, but the differences are small and irregular.

The conclusion is drawn from these experiments that the plasticity of air-dried crepe (six months old) is not greatly affected by the nature or amount of the coagulant when acetic or formic acid or sodium silicofluoride is employed with normal dilutions of latex.

Vulcanisation Tests.

(a) **Rubber-sulphur mixing.**—The following are the results of vulcanisation tests in the rubber-sulphur mixing (90·10), all the samples being vulcanised for 100 minutes at 148°C.

Sample No.	Dilution of latex (per cent.)	Coagulant Nature Quantity used	Tensile Strength (lbs./sq. in.)	Elongation at load of 1·04 kgs./sq. mm. (per cent.)	Calculated time of vulcanisation (mins.)
1286	30	Acetic Normal	1480	907	133
1287	,,	,, 2 x do.	1620	933	140
1288	,,	,, 4 x do.	1660	903	132
1289	,,	,, 6 x do.	1540	925	138
1290	,,	Formic Normal	1950	900	131
1291	,,	,, 2 x do.	1440	926	138
1292	,,	,, 4 x do.	1780	915	135
1293	,,	,, 6 x do.	1770	904	132
1294	15	Acetic Normal	1350	980	151
1295	,,	,, 2 x do.	1480	990	154
1296	,,	,, 4 x do.	1390	972	149
1297	,,	,, 6 x do.	1370	980	151
1298	,,	Formic Normal	1450	960	146
1299	,,	,, 2 x do.	1300	960	146
1300	,,	,, 4 x do.	1630	935	140
1301	,,	,, 6 x do.	1850	910	134
1302	,,	Sodium Normal	1490	975	150
1303	,,	silico 2 x do.	1560	964	144
1304	,,	fluoride 4 x do.	1750	950	147
1305	,,	,, 6 x do.	1380	974	150

The results show that the rubber prepared from the 15 per cent. latex vulcanised more slowly than rubber from the 30 per cent. latex. No conclusions can be drawn from this as the 15 per cent. latex was not obtained by diluting the 30 per cent. latex but by the dilution of another quantity of latex obtained from the same trees two days later. There is no indication that the amounts of the coagulants used have a marked effect on rate of vulcanisation. This is contrary to previous experience with sheet rubber and may be due to the more thorough removal of coagulant in the preparation of thin crepe.

(b) **Zinc-Ozide-Accelerator Mixing.**—The samples were also tested in the mixing 100 rubber, 6 zinc oxide, 2·75 sulphur and 0·4 diphenylguanidine. This mixing has been substituted for the previous accelerator mixing employed in routine tests at the Imperial Institute as the results obtained with it exhibit much wider variation, the cause of which is now under investigation. The results of tests are shown in the following table:—

Period of Vulcanisation at 148°C.

Sample No.	Dilution of latex (per cent)	Coagulant Nature Quantity	40 mins.		60 mins.		75 mins.	
			Tensile Strength (lbs./sq. in.)	Elongation at load of 1·04 kgs./sq. mm. (per ct.)	Tensile Strength (lbs./sq. in.)	Elongation at load of 1·04 kgs./sq. mm. (per ct.)	Tensile Strength (lbs./sq. in.)	Elongation at load of 1·04 kgs./sq. mm. (per ct.)
1286	30	Acetic Normal	1790	810	1750	815	1890	795
1287	,,	,, 2 x do.	1990	810	2070	810	1620	802
1288	,,	,, 4 x do.	1980	800	1900	807	1910	799
1289	,,	,, 6 x do.	1940	800	1970	796	2060	806
1290	,,	Formic Normal	1830	817	1870	804	1910	799
1291	,,	,, 2 x do.	1850	817	1740	801	1920	815
1292	,,	,, 4 x do.	1720	805	1830	795	1850	812
1293	,,	,, 6 x do.	1830	805	1730	814	1830	815
1294	15	Acetic Normal	1830	795	1850	826	1880	808
1295	,,	,, 2 x do.	1980	793	1790	806	1780	810
1296	,,	,, 4 x do.	1760	815	2060	809	1980	806
1297	,,	,, 6 x do.	2120	812	2010	802	1990	799
1298	,,	Formic Normal	1910	814	1930	814	2120	804
1299	,,	,, 2 x do.	2060	799	2070	807	2100	790
1300	,,	,, 4 x do.	1980	820	2180	809	1900	805
1301	,,	,, 6 x do.	2010	815	2030	810	2060	806
1302	,,	Sodium Normal	1770	820	1870	824	1830	828
1303	,,	silico 2 x do.	1650	833	1770	817	1710	814
1304	,,	fluoride 4 x do.	1640	847	1890	830	1800	830
1305	,,	,, 6 x do	1910	816	1920	826	1870	822

The samples have given fairly uniform results, the differences being much less than those previously observed in the case of rubber recently examined from different estates.

Conclusions.

The results indicate that in the case of thin crepe the use of different amounts of acetic or formic acid or of sodium silicofluoride is not a cause of variation in plasticity or in vulcanising and mechanical properties. With this type of rubber therefore the substitution of formic acid or sodium silicofluoride for acetic acid on estates is not likely to give rise to greater variations in the properties of the rubber, owing to diverse practices on the accidental use of excessive amounts of coagulant than has occurred with acetic acid.

Imperial Institute, London,
19th March, 1928.

Report on the Effect on the Development of Mould of Hanging Rubber in the Factory after Smoking.

Previous small scale experiments by Mr. O'Brien indicated that smoked sheet is more liable to develop mould if allowed to hang in the factory before packing.

Further trials have now been carried out on a larger scale with estate rubber which was packed during the showery weather following the S.W. monsoon and forwarded to London for examination on arrival.

The samples consisted of smoked sheet, one portion of which was packed in a wooden chest soon after removal from the smoke house and the remainder after hanging in the packing room for 14 days. Rubber lining sheets were placed round the samples in each case.

The experiment was repeated two days later, the only modification being that a portion of the rubber was hung in the packing room for 15 instead of 14 days.

The chests containing the rubber packed soon after smoking were opened in Ceylon after a fortnight and samples removed as quickly as possible for comparative tests with the rubber hung in the packing room. These tests showed that the samples hung in the packing room had absorbed moisture and in addition had become more liable to develop mould.

On arrival in London the rubber was inspected by a member of the staff and it was found that the sample which had been hung for 15 days in the packing room was mouldy. The corresponding sample hung for 14 days and the two samples packed soon after smoking had not developed mould.

In accordance with Mr. O'Brien's request samples were removed from the centre of each chest, transferred to stoppered bottles, inocculated subsequently with a pure culture of Oospora sp., and kept at 29°C over a 7 per cent. salt solution. After 14

days a comparison was made of the amount of mould on the four samples with the following results:—

Experiment	When Packed	Percentage of Moisture on Arrival	Estimated Percentage of Sample Covered with Mould after 14 days test.
First	Packed 1 hour after smoking ...	0·30	10
Second	Packed 1 hour after smoking ...	0·40	10
First	Hung 14 days after smoking ...	0·33	20
Second	Hung 15 days after smoking ...	0·25	60

It will be seen that the samples of rubber which had been hung in the packing room developed much more mould than those packed soon after smoking. The duplicate samples which were hung in the packing room showed considerable difference in the extent of mould development; the sample giving the highest results was the one which had become mouldy during transit to London.

These results confirm Mr. O'Brien's conclusions that smoked sheet packed directly after smoking is less liable to develop mould than when allowed to hang for some time in the packing room.

Imperial Institute, London,
19th March, 1928.

Report on Effect of Smoking Sheet with "Uncombusted" Smoke.

Small scale experiments by Mr. O'Brien have shown that sheet dried in " uncombusted " smoke requires less firewood and is less liable to develop mould than sheet dried in "combusted" smoke. "Combusted" smoke is derived from fuel burnt with a larger supply of air than in the case of "uncombusted" smoke.

The following report deals with the results of the investigation of samples prepared in connection with further experiments carried out by Mr. O'Brien on a larger scale, the old Rubber Growers' Association laboratory being used for smoking with "uncombusted" smoke. The smoke was produced from rubber wood burning in a 5 gallon oil drum fitted with a perforated lid. The temperature was maintained between 110°F and 115°F by means of charcoal braziers.

Latex was obtained from the Culloden S. Division factory and sheet prepared by the estate method, which is very similar to that suggested by the Rubber Growers' Association. Six sheets were smoked in the S. Division smoke house continuously for 14 days, and an equal number in the experimental smoke chamber for 16 days of 10 hours a day.

Mr. O'Brien reported that the sheets from the experimental smoke chamber were darker than those from the estate smoke house, and slightly more shiny—a defect usually associated with rapid smoking. On arrival at the Imperial Institute there was only a slight difference in the appearance of the samples, this difference being similar in character to that described by Mr. O'Brien.

Tests conducted by Mr. O'Brien on the liability to mould showed that the rubber from the experimental smoke chamber was more resistant to mould growth than that smoked on the estate.

The following are the results of plasticity and vulcanisation tests at the Imperial Institute:—

1. Plasticity.

Sample No.	Type of smoke	Raw Rubber.		Masticated Rubber	
		D30	Time of mastication	D30	Ev.
		(mm./100)	(mins.)	(mm./100)	(ccs.)
1311	"Combusted smoke" ...	145	22½	77	10·8
1312	"Uncombusted smoke" ...	157	23	76	12·8

2. Vulcanisation tests.

Sample No.	Type of smoke.	Tensile Strength	Elongation		Calculated time of vulcanisation.
			At Break.	At load of 1·04 kgs./sq.mm.	
		(lbs./sq. in.)	(mins.)	(per cent)	(mins.)
1311	"Combusted smoke" ...	1530	959	936	140
1312	"Uncombusted smoke" ...	1240	957	975	150

There is no important difference in the results. As in the case of a similar smoking experiment carried out previously on a smaller scale the sample smoked with "uncombusted" smoke is a little more plastic after mastication than that smoked with combusted smoke.

The present samples vulcanise slowly, that smoked with "uncombusted" smoke being exceptionally slow curing. The tensile strengths are satisfactory for the state of cure, but are slightly below the average.

Imperial Institute, London, S.W. 7.
15th February, 1928.

Standardisation of Methods of Testing.

The question of methods of testing raw rubber was discussed at a conference held on 13th October, 1927, between Dr. de Vries of the Central Rubber Station and representatives of the London Committee of the Ceylon Rubber Research Scheme, and it was agreed that standardisation is desirable.

The methods employed by the planters' research organisations for vulcanisation tests have all developed along similar lines differing only in detail. In view of the fact that sufficient data has been collected it seems desirable that uniform methods should be employed as even small differences in procedure complicate comparison between the results obtained in different laboratories.

It is considered that as far as the planters' research organisations are concerned standardisation is feasible and, it is suggested, that if a method of testing is agreed upon by these organisations it should be submitted to the Rubber Division of the American Chemical Society, the Netherland Research Institute at Delft and the Research Association of British Rubber and Tyre Manufacturers.

In order that the laboratories concerned may have the fullest opportunity of studying these questions it is suggested that the Rubber Research Institute, Malaya, should be informed of the duplicate tests in progress in Java and at the Imperial Institute, and invited to participate in further work.

The methods now generally employed in the three laboratories together with those used in the duplicate tests are shown in the following table:—

Testing Station	Parts sulphur per 100 of rubber	Temperature of vulcanisation	Standard of Vulcanisation
*Department of Agriculture, Malaya	11·1 (90 10)	140°C	Standard curve.
Central Rubber Station, Java	8·1 (92·5·7·5)	151°C	Elongation 890% at load of 1·30 kgs./sq. mm.
Imperial Institute, London	11·1 (90·10)	148°C	Elongation 775% at load of 1·04 kgs./sq. mm.
Duplicate tests in Java and at the Imperial Institute	100·10	148°C-151°C	None at present but the usual load and elongation figures are determined from stress-strain curves.

* No information is available concerning the methods to be adopted by the Rubber Research Institute, Malaya.

Observations on Method used for Duplicate Experiments.

Mixing.—The 100·10 rubber-sulphur mixing has the approval of the Rubber Division of the American Chemical Society and it is useful to express the proportion of any compounding ingredients in terms of 100 parts of rubber.

In laboratories where a large number of samples has to be tested it is necessary that vulcanisation should be carried out expeditiously and a temperature near 150°C would be the most suitable for this purpose.

Standard of vulcanisation.—Both the Central Rubber Station, Java, and the Ceylon Rubber Research Scheme (Imperial Institute) vulcanise to a fixed elongation at a definite load. This has the advantage of being more clearly defined than the standard curve. It should not be difficult to agree upon a suitable standard of vulcanisation when the 100·00 mixing has been more fully studied.

Plasticity tests.—It is desirable that steps should be taken to avoid the independent development of plasticity tests on different lines by the various research organisations and for this purpose it would be of considerable advantage if a scheme could be agreed on for the investigation of methods of testing.

Imperial Institute, London,
January 27th, 1928.

Departmental Notes.

Report on Rubber Manurial Experiments, Experiment Station, Peradeniya, for 1927.

IN accordance with the decision made at the Estates Products Committee meeting in July, 1927, both manurial experiments in progress were discontinued at the end of 1927 and this is therefore the last report on these experiments to be published.

The Old Manurial Experiment.

Each plot consists of one double row of trees, the number varying between twenty-five and forty-two.

Manures were first applied in 1913. In 1916 slight alterations were made in the actual constituents of the mixtures but not in their general nature. The following mixtures have been applied since 1916.

GENERAL MIXTURE.
Rows 83 A and B.

lbs. per acre. Annually

Sulphate of Ammonia..... 60	Supply-	
Ground-nut cake.....200	ing N	50 lb.
Blood Meal.....200	„ P_2O_5	30 „
Steamed bone meal.....136	„ K_2O	30 „
Sulphate of potash.....75		
671		

EXCESS OF NITROGEN.
Rows 83 D and 84 A.

Ground-nut cake.....182	Supply-	
Steamed bone meal.....43	ing N	80 lb.
Blood meal.....300	„ P_2O_5	9½ „
Sulphate of Ammonia....150		
675		

EXCESS OF PHOSPHORIC ACID.
Rows 84 C and D till 1923, then Rows 85 D and 86 A.

lbs. per acre. Annually

Ground-nut cake.....50	Supplying	
Steamed bone meal.....200	P_2O_5	80 lb.
Basic slag.....200	„ N	9½ „
450		

CONTROL (No manure and no cultivation).
Rows 85 A and B.

EXCESS OF POTASH.
Rows 85 D and 86 A till 1923, then Rows 84 C and D.

lbs. per acre Annually.

Ground-nut cake.....136	Supplying	
Sulphate of potash.....200	„ K_2O	80 lb.
336	„ N	9½ „

It may be noted that the terms "Excess of Nitrogen," "Excess of phosphoric acid," etc., are not fully descriptive since in these mixtures not only is one constituent present in larger quantities but another is absent altogether.

The manures are applied in shallow trenches which of recent years have been dug one year down the middle of the double row, the next year across the rows between alternate pairs of trees, and the next year across the rows in the spaces not manured in the previous year.

Since only one plot is allotted to each treatment, the figures obtained do not admit of statistical analysis and the reliability of any conclusions arrived at is considerably lessened.

It will be noted that a change in manuring was made in 1923. In that year, and subsequently the excess of phosphoric acid mixture which had hitherto been applied to rows 84 C and D, comprising the plot which had up to date given the highest yield per tree, was applied to rows 85 D and 86 A, comprising the plot which had hitherto given the lowest yield per tree.

Yield.

In Table 1 the statements of yield have been divided into two periods—before and after the change in manuring. The graph shows the yields of each plot throughout.

Before attempting to discuss the differences in the yields of the plots it will perhaps be as well to attempt to arrive at a conclusion as to whether these differences are the result of differential manuring or whether they are due to soil heterogeneity or to the chance differences in the number of natural high yielders in each plot. Some evidence on this point is furnished by the results of the change in manuring in 1923. This change is indicated by a vertical line in the graph. The graph also shows us that the original excess of phosphoric acid plot started in 1914 as the second highest yielding plot and the original excess of potash as the lowest yielding plot: the difference in yields between these two plots is slightly accentuated in 1915 but thereafter, except for a fluctuation in 1921, the relation between the yields of the two plots is fairly constant up to the change in manuring. In 1923, as stated, these two mixtures were exchanged. If, then, the relative position of these two plots was due to the manurial mixtures they received, when these mixtures were exchanged we should expect to see the two lines converging and finally crossing. In fact, however, the two lines are found to diverge still further in 1923 while in 1924 the divergence is accentuated more than ever before. Thereafter there is a convergence, but even in 1927 the lines are scarcely closer than they were in 1916, 1919 or 1920. We find, therefore, in the graph very little evidence that the exchange of these manurial mixtures has effected a corresponding change in the yields of the plots.

Turning to Table 1 an examination of the actual yields per tree of the two plots in question before and after the change in manuring give us the following:—

	Yield per tree 1914-22	Average annual yield 1914-22
	lb. oz.	lb. oz.
Rows 85 C and D ...	38 8	4 3
Rows 85 D and 86 A ...	29 15	3 5
Difference		14

	Yield per tree 1923-27	Average annual yield 1923-27
	lb. oz.	lb. oz.
Rows 85 C and D ...	30 12	6 2
Rows 85 D and 86 A ...	23 0	4 9
Difference		19

Old Manurial Experiment. Table 1.

Average Yields Dry Rubber Per Tree.

Plot	1914 - 1922 lb. oz.	Average Annual increase 1914 - 1922 lb. oz.	Increase or decrease Compared with control. 1914 - 1922 lb. oz.	1923 - 1927 lb. oz.	Average Annual increase 1923 - 27 lb. oz.	Increase or Decrease compared with control 1923 - 1927 lb. oz.	Total 1914 - 1927 lb. oz.	Average annual Increase 1914 - 1927 lb. oz.	Increase or Decrease Compared with control 1914 - 1927 lb. oz.
Rows 83 A & B General Mixture.	35 15	— 4 2	— 2	29 2	— 2 6	+2 14	65 1	— 4 0	+2 12
Rows 83 D & 84 A Excess of Nitrogen.	36 9	— 4 5	+ 8	31 12	— 11 0	+5 8	69 5	6 0	+7
Rows 84 C & D Original excess of Phosphoric acid. Now excess of Potash	38 0	— 4 9	+1 15	30 12	— 3	+4 8	68 12	3 9	+6 7
Rows 85 A & B Control.	36 1	— 4 1	— —	26 4	— 5 3	— —	62 5	3 3	—
Rows 85 D & 86 A Original excess of Potash. Now excess of Phosphoric acid.	29 15	— 3 5	—6 2	23 0	— 8 0	—3 4	52 15	4 0	9 6

This however is largely due to a spurt in one year, 1927; a year in which the yields of the other plots all fell.

In other years the graph will show that this plot has shown no special pre-eminence.

One must finally conclude that it would be unsafe and inadvisable to assume that the differences in yields of these plots are due to the manures applied to them.

In fact, instead of the difference in average annual yield per tree in the two plots becoming less after the exchange of the manurial mixtures it has actually increased by 11 oz. If we now examine the columns "Annual average increase" we do at last find some indication of the reversal we are looking for after the change in manuring. In the first period the average annual increase for Rows 84 C and D was 4·9 oz. against a decrease of 3 oz. in the second period, while in the case of Rows 85 D and 86 A the average annual increase was 4·1 oz. for the first period and 5·3 oz. for the second period.

In view of the evidence previously noted however it appears at least extremely doubtful whether phosphoric acid or potash has had any effect on the yields of the plots.

With regard to the behaviour of the plots relatively to the control plot, the graph shows that the control plot started in the first place and gradually sank to third place in 1927. It is to be noted however that this plot exceeded the yield of the excess of nitrogen plot (which has given the highest yield over the whole period) in the years 1915, 1916 and 1922; it also exceeded the yield of the Original Excess of phosphoric acid plot (which has given the second highest yield over the whole period) in the years 1915, 1919 and 1920 and equalled it in 1922. Moreover if the superior yield of Rows 84 C and D during the first period was due to the application of the excess of phosphoric acid mixture then, when that mixture was applied in the second period to Rows 85 D and 86 A one would at least expect the yield of the plot to rise to the level of the control plot. This has not occurred; in fact the plot is almost exactly the same distance behind the control plot as it was in 1914 and the difference has remained very constant during the whole period.

The excess of nitrogen plot has given the highest yield over the whole period; also the largest average annual increase, and the largest increase over the control plot.

Table 2

Average Girths and Bark Renewal.

Plot	January 1914 inches	January 1923 inches	Increase 1914-1923 inches	January 1923 inches	Increase 1924-1927 inches	Increase 1914-1927 inches	Average thickness of cortex 1 inch below top of last tapped panel. Millimetres
Rows 83 A and B General Mixture.	29·4	52·4	23·0	60·4	7·6	31·0	4.0
Rows 83 D and 84 A Excess of Nitrogen.	29·7	53·5	23 8	60·1	6 6	30·4	3·8
Rows 84 C and D Original excess of Phosphoric acid. Now excess of Potash.	29·7	52·8	25·1	59·9	7·1	30·2	3·9
Rows 85 A and B. Control.	29·7	55·2	25·5	60·2	5·2	30·5	4·0
Rows 85 D and 86 A Original excess of Potash. Now excess of Phosphoric acid.	29·7	51·9	22·6	57·6	5·7	27·9	3·9

Growth and Bark Renewal

Table 2, like Table 1, is arranged in two periods—before and after the change in manuring.

All the plots started with practically the same average girth. At the end of the first period, the difference in increase in girth between the original excess of phosphoric acid plot and the original excess of potash plot was 2·5 inches. At the end of the second period, after the change in manuring the difference in increase of girth between the two plots was 1·4 inches, a decrease of about 1 inch. The original excess of potash plot has throughout shown the lowest increase in girth. The bark renewal figures show no significant differences.

Disease.

The disease incidence is negligible and insignificant.

The Avenue Rubber Manurial Experiment.

The plots used in this experiment consist of seven double rows or avenues in which the trees are planted 15 ft. by 15 ft. with 40 ft. between the avenues. Manures were first applied in 1916 and tapping commenced in April, 1922. The mixtures applied annually are as follows:

Plot.	Treatment.			
Control.	Lime only	...	8 lb. per tree	
Plot 1.	Superphosphate	...	138 lb. per acre	Nitrogen omitted.
	Sulphate of potash	...	147 lb. per acre	
	Lime	...	8 lb. per tree	
Plot 2.	Nitrolim	...	277 lb. per acre	Phosphoric acid omitted.
	Sulphate of potash	...	120 lb. per acre	
	Lime	...	8 lb. per tree	
Plot 3.	Nitrolim	...	277 lb. per acre	Potash omitted.
	Superphosphate	...	138 lb. per acre	
	Basic slag	...	174 lb. per acre	
	Lime	...	8 lb. per tree	
Plot 5.	Same manures as 1 but no lime.			
Plot 6.	Same manures as 2 but no lime.			
Plot 7.	Same manures as 3 but no lime.			

The manures are applied annually in the same manner as in the old manurial experiment, except the lime which is broadcasted and discharrowed or lightly forked in, usually about 3 weeks before the application of the manures.

The number of trees per plot varies between 21 and 37.

It will be noticed that here again only one plot is allotted to each treatment so that the results cannot be statistically analysed.

A study of Table 3 reveals the fact that the plot receiving lime only has given the largest yield in practically every year and by far the largest average annual increase in yield. This control plot however is the end plot of the block and is surrounded on three sides by a drain and a road at a lower level than the plot. Across this road at the end of the block is a plot of cacao, but this is lower than the rubber and the outer row of the control plot certainly gets more light and air than any other plot and in consequence shows great superiority in foliage.

Table 3

Average Yields Per Tree.

Avenue Rubber Manurial Experiments.

Plot.	Treatment	1922 9 months only lb. oz.	1923 lb. oz.	1924 lb. oz.	1925 lb. oz.	1926 lb. oz.	1927 lb. oz.	Total 1922 - 1926 lb. oz.	Average annual increase lb. oz.
Control.	Lime only	2 3	3 1	3 11	4 8	4 5	4 7	22 3	9 2
1	Mixture without nitrogen + Lime	1 13	2 13	3 12	3 12	2 3	3 8	18 3	5 4
2	Mixture without phosphoric acid + Lime	2 0	2 14	3 10	3 8	3 6	3 10	19 -	5 2
3	Mixture without Potash + Lime	1 12	2 6	3 6	3 1	2 14	3 1	16 8	4 2
5	Mixture without nitrogen	1 15	2 13	3 10	3 13	3 7	3 7	19 1	4 8
6	Mixture without phosphoric acid	1 14	2 7	3 4	3 6	2 15	3 5	17 10	5 6
7	Mixture without potash	1 11	2 5	3 7	3 3	2 11	3 -	16 5	4 2
Rainfall.	Inches	83·27	116·08	90·90	106·53	85·74	86·78		

It is quite possible that this superiority of aspect has influenced the yield per tree. The superiority of the control plot over the average of the three plots receiving lime and manures amounts for the whole period to 4 lb. 3 oz. per tree and is far more striking than the superiority of the average yield of the three plots receiving lime and manures over that of the three plots receiving the same manures but no lime, which only amounts to 9 oz. per tree for the whole period. This inclines one to the view that the superiority of the control plot is not due to the lime but to aspect or to the inclusion of a larger number of natural high yielders.

Turning to the manurial mixtures the omission of neither nitrogen nor phosphoric acid appears to have had any marked effect on yield. The plots from which potash is *left out* have given the lowest yield both with and without lime. In this connection it will be recollected that in the old manurial experiment the plot which received *an excess* of potash gave the lowest yield throughout.

As regards yields therefore the evidence that the differences which appear are due to manurial treatment is inconclusive and contradictory.

Table 4 shows the position as regards growth, as indicated by girth, and bark renewal.

Table 4

Girths and Bark Renewal Measurements.
Avenue Rubber Manurial Experiments.

Plot	Treatment	Average girth 1916 inches	Average girth 1928 inches	Increase in girth inches	Average thickness of renewed cortex at point of measurement Millimetres
Control.	Lime only ...	6·00	43·25	37·25	4·1
1.	Mixture without nitrogen+ lime ...	7·25	42·37	35·12	4·8
2.	Mixture without phosphoric acid + lime ...	6·85	42·00	35·15	4·2
3.	Mixture without potash + lime ...	7·04	41·75	34·71	4·1
5.	Mixture without nitrogen ...	7·40	42·50	35·10	4·1
6.	Mixture without phosphoric acid ...	8·00	42·00	34·00	3·8
7.	Mixture without potash ...	8·30	42·00	35·70	4·2

Again the control plot is in the lead, the remainder show only trifling differences.

There appear to be no significance in the average thickness of renewed cortex.

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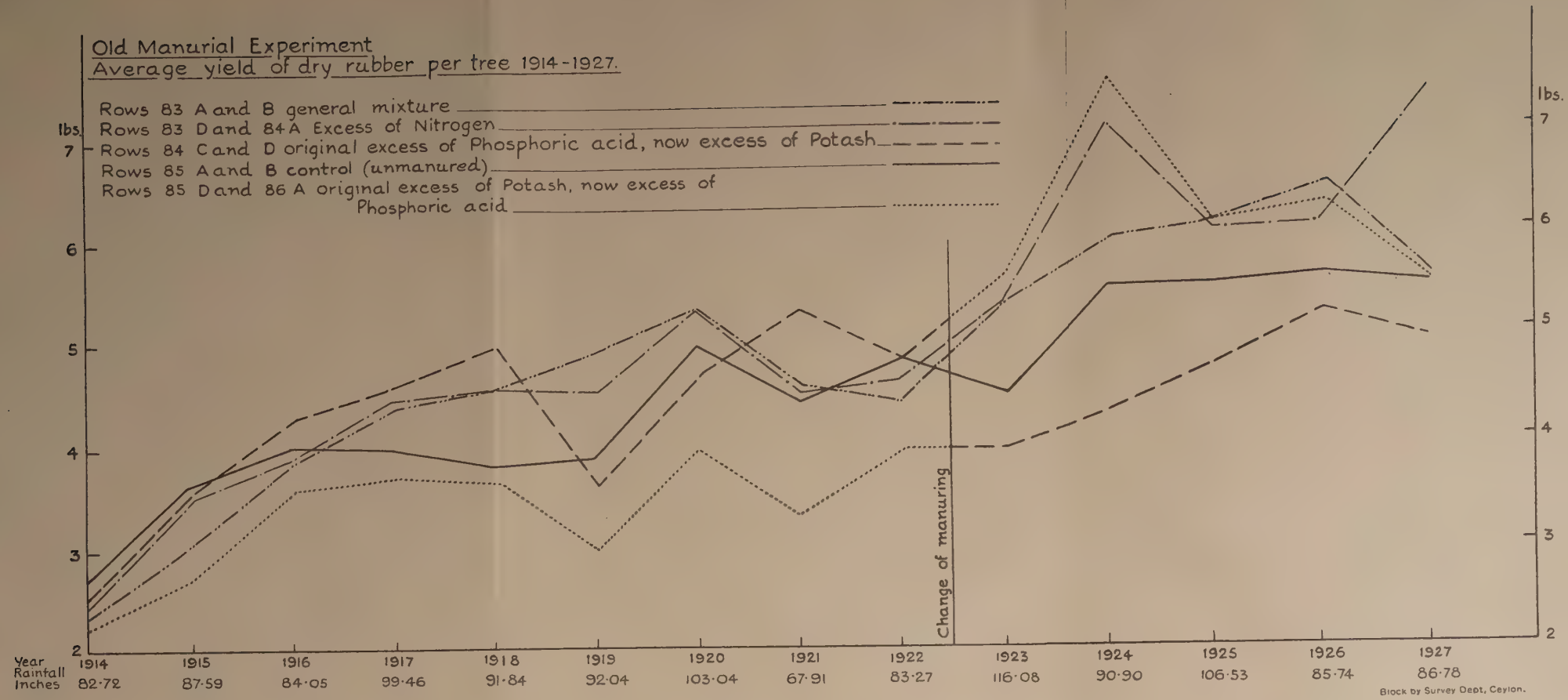
Old Manurial Experiment
Average yield of dry rubber per tree 1914-1927.
Rows 83 A and B general mixture
Rows 83 D and 84 A Excess of Nitrogen
Rows 84 C and D original excess of Phosphoric acid, now excess of Potash
Rows 85 A and B control (unmanured)
Rows 85 D and 86 A original excess of Potash, now excess of Phosphoric acid
lbs.
7
6
5
4
3
2
Change of manuring
Year 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927
Rainfall Inches 82·72 87·59 84·05 99·46 91·84 92·04 103·04 67·91 83·27 116·08 90·90 106·53 85·74 86·78
Block by Survey Dept, Ceylon.

Report on Rubber Tapping Experiments, Experiment Station, Peradeniya, 1927.

Plots, 151—154.

Old Two-day Versus Three-day Tapping Trials.

THIS experiment was stopped at the end of 1927 after running for 9 years. Table 1 shows the average yields per tree.

The two-day and three-day tapping blocks are arranged alternatively. It will be noticed that the yields generally tend to increase when passing from series 1 to series 6. Since in both methods of tapping the cuts started at the same height from the ground it follows that the relative yields obtained by the two methods will fluctuate according to the distance down the tree that the cuts in each method have reached in any particular year. The two-day tapping allows for a 6 years' renewal and the three-day in this case for nine years' renewal.

The block contains the poorest rubber on the station. The trees were interplanted among tea in 1908 and the block has not been manured since the tea was cut out in 1916. Fomes lignosus appeared early and in all 14 trees have been lost.

Judging from the results of this experiment and those of a similar experiment—to be described later—in which the cuts on the trees tapped every three days are started at two-thirds the height at which the two-day tapping cuts are started, if it is desired to increase the tapping interval with the least possible loss of crop it will be preferable to confine the three-day tapping cut to the lower level than to start it at the same height as the two-day tapping cut and obtain a nine years' renewal.

Table 1.

Old Two-day Versus Three-day Tapping Trials.

Average Yields of Dry Rubber per Tree.

Year	Two-day Tapping				Three-day Tapping				
	Series 1	Series 3	Series 5	Average of Two-day Series.	Series 2	Series 4	Series 6	Average of Three-day Series.	Percentage of Two-day tapping yields obtained by Three-day tapping
	lb. oz.	lb. oz.	lb. oz	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz	
1919	3 2	3 4	3 4	3 3	2 5	2 4	2 8	2 6	73·6
1920	3 12	3 7	3 7	3 9	2 7	2 10	2 8	2 8	70·9
1921	4 3	4 2	4 5	4 3	2 15	2 12	3 3	2 15	69·6
1922	4 0	4 5	5 1	4 9	3 4	3 5	4 3	3 9	80·3
1923	3 9	4 7	3 13	3 15	1 15	2 6	3 1	2 7	57·5
1924	3 14	4 13	5 6	4 11	3 3	3 2	3 14	3 8	66·6
1925	3 10	3 13	4 5	3 15	2 13	2 11	2 15	2 13	71·2
1926	3 3	3 3	3 11	3 6	2 4	2 1	2 6	2 4	66·6
1927	4 6	3 14	4 13	4 5	2 10	2 7	2 14	2 10	60·8
	33 11	35 4	38 1	35 12	23 12	23 10	27 8	25 0	70 0

A census of diseased trees taken at the end of 1927 showed the following situation as regards brown bast.

Two-day tapping.

Series 1	2 cases
Series 3	2 cases
Series 5	1 case

Three-day tapping.

Series 2	Nil
Series 4	Nil
Series 6	Nil

In every year the position has been the same in both two-day *vs.* three-day tapping experiments, and there seems little doubt that the incidence of brown bast is reduced by increasing the tapping interval from two to three-days.

The Hill Top Rubber.

This block contains three experiments. It will be convenient first, to deal with the new two-day versus three-day tapping trials for comparison with those already described.

New Two-day versus Three-day Tapping Trials.

This experiment is being conducted in Block C of the Hill Top Rubber. The trees are planted 20 ft. by 20 ft. on rather steep and rocky land.

Tapping with a single cut at 16° on the half circumference was started on April 1st, 1922. In this case the cuts on the trees tapped every three days were started at 16 inches from the ground at the lower end while those on the trees tapped on alternate days were started at 24 inches from the ground. The two cuts therefore reach the bottom of the panel at the same time and in both cases there is a 6 year bark renewal period.

Table 2 shows the average yields per tree.

In this case up-to-date a yield of 80·5 per cent. of the two-day tapping yield has been obtained from three-day tapping, i.e., 10 per cent. more than was obtained in the older experiment where all the cuts were started at the same height.

Judging from these figures three-day tapping forms an economical method of restricting output.

As regards brown bast the position is similar to that found in the old experiment.

Two-day tapping.

Series 1	2 cases
Series 3	2 cases
Series 5	3 cases

Three-day tapping.

Series 2	Nil
Series 4	Nil
Series 6	Nil

Methods of Planting.

The three blocks of the Hill Top Rubber are planted in three different methods. These blocks are really not strictly comparable since Block A is on a gentle slope, Block B on flat land, and Block C on steep rocky land. Moreover in Blocks A and B half the trees are tapped with a V cut and half with a single cut, and in Block C half the trees are tapped on alternate days and half every three days. Comparison can therefore only be made between those trees which are tapped with a single cut on alternate days, and only the yields from such trees are included in the following table.

Table 2.

New Two-day Versus Three-day Tapping Trials.

Average Yields of Dry Rubber per Tree.

Year	Two-day Tapping				Three-day Tapping				
	Series 1	Series 3	Series 5	Average of Two-day Series.	Series 2	Series 4	Series 6	Average of Three-day Series.	Percentage of Two-day tapping yields obtained by Three-day tapping
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	
1922 (April to Dec.)	2 2	2 3	1 13	2 1	1 10	1 9	1 9	1 9	75·5
1923	3. 0	3 2	2 10	2 15	2 10	2 4	2 8	2 8	85·1
1924	3 6	4 1	3 5	3 9	2 12	2 13	2 13	2 13	79·0
1925	3 6	3 12	3 13	3 11	2 15	2 15	2 15	2 15	81 4
1926	3 3	3 4	3 1	3 3	2 14	2 12	2 11	2 11	80 4
1927	3 5	2 15	3 8	3 4	2 6	2 8	2 7	2 7	76 9
Total	18 6	19 5	18 2	18 10	15 3	14 13	14 15	15 0	80·5

Table 3.

Methods of Planting.

Block and method of planting	Number of trees per acre	Average yields per tree			Calculated yield per acre		
		1927	Previous (1922-1926)	Total to date	1927	Previous (1922-1926)	Total to date
		lb. oz.	lb. oz.	lb. oz.	lb.	lb.	lb.
A. Clumps of 4 trees 12 ft by 15 ft. with 40 ft. between clumps ...	69	5	18 8	23 8	345	1416	1761
B. Avenues. Trees 12 ft. by 15 ft. with 40 ft. between avenues ...	112	2 14	12 15	15 13	322	1415	1737
C. Square planting 20 ft. by 20 ft. ...	109	3 4	15 4	18 8	354	1637	1991

The yield per tree of the trees planted in widely spaced clumps of 4 is markedly superior, so much so that with only 69 trees the calculated yield per acre is superior to that of the avenue planting which gives 112 trees per acre and not very far behind the square planting. This result lends colour to the view that the superiority of yield of the control plot in the Avenue Rubber Manurial Experiment is due to this plot being at the end of the block. It would appear that some modification of the clump system designed to give a few more trees per acre might be worth a trial. The system gives additional facilities for the cultivation of a catch crop, or of green manure crops, in the early stages of growth of the rubber.

It is somewhat difficult to account for the superiority of the square planting over the avenue planting. A possible reason is that in the former case the land being steep each individual tree obtains more light and air than in the avenues where the land is flat.

The average girth of all trees in tapping in the three blocks are given below:—

	Dec., 1921	Dec., 1927	Increase in 6 years
	Inches	Inches	Inches
Block A ...	28·5	42·5	14·0
Block B ...	29·5	40·8	11·3
Block C ...	27·5	37·7	10·2

The trees in widely spaced clumps have shown the greatest girth increase.

Single Cut Versus V Cut.

As stated, half the trees in Blocks A and B are tapped with a V cut and half with a single left to right cut. In both cases the cuts occupy half the circumference and all cuts are the same height from the ground.

Table 4 shows the average yields per tree since the start of the experiment.

Table 4.

Single cut Versus V cut. Average Yields per Tree.

Year	Single cut			V cut			Average increase per tree from use of V cut
	Block A	Block B	Average	Block A	Block B	Average	
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	
1922 (April to Dec.) ...	2 7	1 12	2 1	2 5	1 12	2 0	— 1 oz.
1923 ...	3 11	2 4	3 0	4 0	2 12	3 6	+ 8 oz.
1924 ...	4 14	2 13	3 13	5 10	3 7	4 8	+11 oz.
1925 ...	5	3 2	4 1	5 7	3 10	4 9	+ 8 oz.
1926 ...	4 8	3 0	3 12	5 3	3 0	4 1	+ 5 oz.
1927 ...	5	2 14	3 15	5 6	3 9	4 7	+ 8 oz.
Total ...	25 8	15 13	20 9	27 15	18 2	22 13	+ 2 lb. 6 oz

After the first 9 months the yields from the trees tapped with a V cut have maintained a steady superiority, the increase since April 1st, 1922, now amounting to 2 lb. 6 oz. per tree.

The percentage of scrap from these two methods of tapping has been as follows:—

	Single Cut Per cent.	V. Cut Per cent.
1922 ...	11·0	11·6
1923 ...	10·7	13·9
1924 ...	16·8	14·4
1925 ...	17·7	10·0
1926 ...	23·3	19·0
1927 ...	17·1	17·9
Average ...	16·1	14·5

There is an advantage of 1·6% in favour of the V cut.

The Hillside Rubber.

The experiment here in progress is a comparison between

(1) Tapping on alternate days throughout the year.
(2) Tapping daily in the months of January, March, May, etc.
(3) Tapping daily in the months of February, April, June, etc.

The incidence of Brown bast is of great importance in this experiment.

The present incidence is as follows:—

Tapping alternate days throughout the year.

Series	No. of trees	No. of cases	Percentage affected.
1	64	2	3·1
6	63	2	3·2

Tapping daily and resting alternate months.

Series	No. of trees	No. of cases	Percentage affected.
2	64	5	7·7
3	64	4	6 2
4	64	4	6·2
5	63	2	3·2

The difference in incidence is not very striking but from the start of the experiment a higher percentage of cases has been found among the trees tapped daily in alternate months.

Change-over Experiment.

There are twenty-four plots of sixteen trees each used in this experiment. In eight plots there is no change-over till the panel is finished, in eight plots the cut is changed over once a year, in eight plots once in six months. Since the cuts will of necessity be at different heights after the first six months no reliable comparison of yield will be possible till both panels have been completed. Measurements of renewed bark are to be taken periodically; the first measurements in the case of two methods were taken on April 1st, 1928. In the case of the third block measurement is not due till October 1st, so that any comment would be at present premature.

Left Versus Right Cut.

This experiment was started on April 1st, 1926, on 114 old trees in plot 87. One right-to-left and one left-to-right cut is made on every tree and the latex from all the right-to-left cuts and all the left-to-right cuts is collected separately. In the first year the yield from the left-to-right cuts (the ordinary estate method) exceeded that from the right-to-left cuts by 8%; in the second year (ending 31st March, 1928) 5% greater yield

Table 5.

Average Yields per Tree in Hillside Rubber.

Year	Alternate days throughout the Year. Series 1	Series 6	Average	Daily in January, March, May, etc. Series 2	Series 4	Average	Daily in February, April, June, etc. Series 3	Series 5	Average	Average of daily tapped blocks.
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb oz.	lb oz.
1922 (April to December)	1 14	1 14	1 14	1 13	2 0	1 14	1 15	1 15	1 15	1 15
1923	3 8	3	3 4	3	3 3	3 2	2·14	3	2 15	3
1924	4 1	3 11	3 14	3 9	3 8	3 8	3·14	3 14	2 13	3 11
1925	3 13	3 4	3 9	3 10	3 9	3 9	3·12	3 15	3 14	3 11
1926	3 10	3 5	3 8	3 11	3 9	3 10	4·5	3 8	3 15	3 13
1927	4 4	4 12	4 8	3 5	3 12	3 8	3·14	4	3 15	3 12
Total	21 2	19 14	20 9	19	19 9	19 3	20 10	20 4	20 7	19 14

was obtained from the right-to-left cuts. The present indication therefore is that the yield is not affected by reversing the slope of the cut.

The Brown Bast Exhaustion Theory Experiment.

This experiment was started at the request of the Plant Physiologist, Rubber Research Scheme, on April 1st, 1926.

103 untapped trees were utilised and two cuts, each occupying one-third of the circumference, were put on each tree. All cuts were tapped daily. One cut on each tree was called the X cut and from this cut the latex was collected in the normal way. To the other cut, called the Y cut, methylated spirit was applied as soon as the excision was made in order to coagulate the latex as soon as it emerged and stop the flow. The object of the experiment was to endeavour to ascertain whether the actual excision of bark or the withdrawal of latex was the predominant factor in inducing brown bast.

For the first two months the latex was not collected from the Y cuts, but when it was found that the application of methylated spirits was not entirely effectual in stopping the flow, latex was collected from both cuts in order to compare the amount withdrawn. Subsequently three applications of methylated spirit were made to each cut instead of only one immediately after tapping.

Omitting the first two months, the latex actually collected from the cuts up to March 31st, 1928, was as follows:—

X cuts	1080560 cc
Y cuts	407060 cc

From the Y cuts therefore only 37% of the yield of latex of the X cuts was withdrawn.

The third and final examination of the trees was made by the Plant Physiologist, Rubber Research Scheme, on May 9th, 1928. It was found that 58 of the X cuts (56%) were affected with brown bast, and 57 (55%) of the Y cuts.

It appears to be indicated therefore that the withdrawal of latex has no influence on the incidence of brown bast.

The high rate of brown bast incidence induced by daily tapping is worthy of note.

The experiment was discontinued after this examination.

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Progress Report of the Experiment Station, Peradeniya.

For the Months of March and April, 1928.

Tea.

The usual annual manuring of the plots under *Indigofera endecaphylla* was done in April.

In the last report comment was made on the small number of casualties sustained after the 1927 pruning. Unfortunately during February and March only ·37 inches of rain fell in 44 days, and although the tea was back in plucking a considerable number of deaths occurred. The total losses sustained after the 1927 pruning are now larger than after the 1925 or 1923 prunings.

10 typical specimens of bushes sent to the Mycologist were all reported to be affected by *Rhizoctonia bataticola*. On five bushes *Diplodia* was also present and in five cases *sphaerostilbe* was found. The Mycologist is of the opinion that *Rhizoctonia* was responsible for the loss of the bushes.

October and November do not appear to be suitable months for pruning at Peradeniya, and the most serious consequence of these casualties is in the small manurial plots. Many of these plots now contain a number of bushes varying between 30 and 40 and it may be necessary to calculate yields from the surviving bushes.

The manures were applied in March to these small manurial plots according to the scheme.

Rubber.

In the Bandaratenne rubber tapping was commenced on April 1st in the experiment to compare the yields from plots under a cover of *Dolichos Hosei* which is left untouched and from plots in which the cover is cut and forked in with envelope forking twice a year. The latter plots received one forking in April. There are 6 plots of 26 trees under each treatment.

A new experiment, to be called the "One-third Resting Experiment" was started on April 2nd in the Avenue Rubber where a manurial experiment has been discontinued. Twelve plots of 24 trees each have been laid out. Six of these plots are tapped on alternate days throughout the year. The other 6 plots are each subdivided into 3 sub-plots of 8 trees each named (a), (b) and (c) and one of these sub-plots is rested in turn for a month. Thus, in April the (b) and (c) sub-plots only are tapped, in May the (a) and (c) sub-plots, and in June the (a) and (b) sub-plots. All tapping is on the third circumference; the trees having been previously tapped by this method.

In the plots occupied by the old manurial experiment which was discontinued at the end of 1927 individual yields of dry rubber are to be recorded from May 1st, 1928. After a year or more, an experiment will be commenced in attempting to improve the yield of the block by either budding on to the poor yielders or cutting them out and replacing by budded plants from good yielders.

Cacao.

The cacao year ended on March 31st.

Sixteen 1 acre plots were manured last January with phosphatic and potash manures in accordance with the scheme of the experiment started in the cacao year just completed. Apart from this no manures have been applied to the 38 acres of cacao since 1921. In spite of this the following yields have been obtained in the last five years.

Year.	*Cwt. dry cacao per acre.*
1923-24	2·24
1924-25	3·10
1925-26	5·45
1926-27	5·03
1927-28	4·41

Green Manures and Cover Crops.

A change of plan has been made in the green manure experiment which has been in progress since November, 1926. In this experiment there are ten plots of Dadaps, 10 of Gliricidia, 10 of Tephrosia candida, 10 of Crotalaria anagyroides, 10 of Dolichos Hosei and 10 of Indigofera endecaphylla. In each case in 5 plots the plants are left untouched while in the other 5 they are lopped or cut periodically and the green material buried by envelope forking. There are also bare control plots which are clean weeded monthly. Hitherto soil samples have been taken fortnightly and nitrate determinations made by the Agricultural Chemist. The Chemist has found, however, that the quantity of nitrates present depends so largely on recent rainfall—after a heavy fall practically no nitrates are found—that this method has been abandoned and yearly determinations of total nitrogen and organic matter are to be made.

The original *Crotalaria anagyroides* has died out and these plots have been resown.

Considerable orders for cuttings of *Indigofera endecaphylla* are now being received.

Fruit.

Loquats received from California in May, 1927, are growing vigorously.

Sixteen more imported American grape fruit plants, 2 each of 8 varieties; were planted in the fruit plots in April. These are at present doing well.

A quantity of papaw seed, all taken from the long shaped fruit, was sown in the fruit plots in 1927. Of the resulting plants some bore long fruits, some round fruits and others long and round fruits on the same tree.

Rainfall.

The rainfall for March was 2·98 inches and for April 16·10 inches.

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Manager,
Experiment Station, Peradeniya.

Paddy Cultivation Competition in Siyane Korale East.

A paddy cultivation competition was held for the fourth time in Siyane Korale East of the Colombo District for a prize of Rs. 150/- offered by Mr. J. P. Obeyesekera, Maha Mudaliyar, during 1927-28.

As in previous years the competition was held in two sections—fields over 1 acre in extent and fields of ½ acre to 1 acre in extent—in order to give the average cultivator an opportunity of competing. There was a total of 59 entries for both sections.

The final judging of the fields was done by the Chairman of the Village Committee for Udugaha Pattu in Siyane Korale, assisted by the Agricultural Instructor, Veyangoda.

The drought experienced after the sowing season had interfered with cultivation. Nevertheless a distinct endeavour had been made by some of the competitors to improve their fields.

The following were adjudged winners of prizes:—

1st Section.

1. R. Don Thomas, P.V., Walgammulla. Rs. 75-00
2. D. J. Edirisinghe, P.V., Opathella. Rs. 25-00

2nd Section.

1. D. Alagiyawanna, Meevitigammana. Rs. 30-00
2. Senaratge Charlie, Kegalle. Rs. 20-00

Paddy Cultivation Competition in Matale East.

A paddy cultivation competition was held in Matale Pallesiya Pattu and Ambanganga Korale during the Maha season of 1927-28, when 37 cultivators entered.

The competition was well advertised through the headman.

The registered plots were occasionally visited by the Agricultural Instructor, and were finally judged by the Divisional Agricultural Officer, Central, Peradeniya.

The following have been adjudged winners:—

1 T. B. Weeragama of Weeragama Rs. 30-00

2. H. H. Appuhamy of Weeragama Rs. 20-00

3. Henry Aluvihare of Pussela, Rattota. Hon. Mention

Paddy Cultivation Competition in Matale South.

A successful paddy cultivation competition was held during the Maha Season of 1927-28 for the cultivators of Matale South. There were no less than 326 competitors against 300 the previous year. 76 competitors had transplanted their paddy while the rest had applied green and farm-yard manure, and some had thinned out their fields.

The Agricultural Instructor paid periodical visits to the fields, and the final judging was done by the Divisional Agricultural Officer, Central, Peradeniya, and the Rate Mahatmaya of the division. The following, who had transplanted, were adjudged prize winners:

1. Bannekgedera Kalu Banda of Galehenwatta Rs. 30-00
2. Batuwattagedera Dingiri Banda of Parijjala Rs. 20-00
3. S. M. B. Ammugama of Aluvihare. Hon. Mention.

School Garden Competition in Galle District.

A school garden competition was held in the Galle District for a prize offered by Mudaliyar W. Daniel Fernando Waidyasekera. This was open to all schools possessing registered gardens. The teachers concerned showed considerable interest in this competition, and a total of 33 schools competed.

The following were adjudged winners in this competition.

1. G/Kottawa, B.V. School. Rs. 50-00
2. G/Nagoda, B.V. School. ,, 30-00
3. G/Niyagama, B.V. School. ,, 20-00

School Garden Competition in Matara District.

A school garden competition was held in the Matara District for 3 prizes of Rs. 15/- each offered by the Mudaliyar of Wellaboda Pattu, for Wellaboda Pattu, Mr. D. Samaraweera for Weligama Korale and the Mudaliyar of Gangaboda Pattu. A total of 24 schools competed.

The competing gardens were inspected thrice during the year, and the following were adjudged winners at the final inspection;

Aparekka, B. V. S. in Wellaboda Pattu.
Marambe, M.V.S. in Weligama Korale.
Owitigamuwa, M.V.S. in Gangaboda Pattu.

Home Garden Competition Deraniyagala School.

At a meeting of the residents of Deraniyagala held on King's Birthday of last year at the school hall it was decided that for the encouragement of village agriculture an annual home garden competition be organised for the students—both past and present—of Deraniyagala school. Mr. L. Archdale, Superintendent of Lausahena Estate, who presided at the meeting offered Rs. 20/- annually towards the competition. Mr. R. Fuge, Superintendent of Liniyagala Estate and Mr. U. Y. Garutarahamy, late Korale of Deraniyagala, also promised an annual subscription of Rs. 5/- each.

The first competition proved a great success, in that there were no less than 70 entrants of whom 39 were past students of the school.

The following were adjudged winners:—

Present students' home gardens.

1st—Peter Singho.....Rs. 10-00
2nd—Mathies Singho..... ,, 5-00

Past students' home gardens.

1st—P. N. Kusal Hamy.....Rs. 10-00
2nd—Y. Keriyasaga..... ,, 5-00

Pure Line Paddy Growing Competition.

A pure line paddy growing competition was held in the Yatinuwara and Harispattu areas of the Kandy District during the Maha Season of 1927-28, when 46 growers entered the competition. The paddies grown were all pure-line strains and consisted of B12, B11, P9 and I17.

In the Yatinuwara Area the fields suffered much owing to abnormal weather conditions, and the yields were comparatively poor, and except in four cases, where damage was caused by silting, the pure-line varieties gave better results than the mixed village paddies. Some of the fields entered for competition belonged to Ratwatte Dissawe, and were entirely sown with pure-lines. Considerable damage was caused to these fields by floods at the time of harvesting. The fields in Kendeniya area suffered owing to the bursting of the Inigala Ela bund.

The following have been awarded prizes :—

Yatinuwara.

1st prize Mahavilanda Pina Rs. 45-00
2nd ,, H. Appu (cultivator of Mampitiya R.M's fields Rs. 20-00

Harrispattu.

1st prize C. Dunuwille, Katugastota. Rs. 45-00
2nd ,, P. Kirihamy, Kondeniya. Rs. 20-00

Paddy Cultivation Competition in Matale District.

A paddy cultivation competition was held in the Matale District for cultivators of Gangala and Laggala Korales for the Maha season of 1927-28 and attracted a large number of competitors than last year, a total of 71 competing.

The fields were not transplanted, but were in most cases treated with farm-yard and green manures.

Competitors received instructions from the Agricultural Instructor of the division, and the final judging was done by the Ratemahatmaya of the division in collaboration with the Agricultural Instructor.

The results obtained were satisfactory.

The following won the prizes offered by he Department.

1. V. M. Ukku Banda of Illukkumbara. Rs. 30-00
2. Idamegedera Kalu Banda of Stanwela. ,, 20-00

P. M. Mudalihamy of Mahalokotuwa. Hon. Mention.

Meetings, Conferences, Etc.

Tea Research Institute of Ceylon.

Financial Affairs: Director's Report.

A meeting of the Board of the Tea Research Institute of Ceylon, was held in the Victoria Commemoration Buildings, Kandy, on Friday, March, 23rd.

Mr. R. G. Coombe presided, and the others present were :—The Hon. Mr. F. A. Stockdale, Colonel T. G. Jayewardene, the Hon. Mr. J. W. Oldfield, Messrs. John Horsfall, P. A. Keiller, T. B. Panabokka, W. Coombe and Mr. A. W. L. Turner (Secretary), and by invitation Mr. T. Petch (Director).

Letters and telegrams regretting inability to be present at the meeting were received from Messrs. J. D. Finch Noyes and D. S. Cameron.

Finance.

The CHAIRMAN announced that the final accounts for 1927, showed a saving of approximately Rs. 17,000.

The statement of accounts as at 29th February, 1928, showed a balance in the Bank of Rs. 72,602·34. It was decided to place Rs. 60,000 on fixed deposit for three months.

The CHAIKMAN announced that all members of the Board had agreed that the subordinate staff should be granted a bonus of one month's pay at Christmas 1927. This was confirmed.

Laboratory Assistants.

The Director said that there were now two chemists on the staff and he asked for sanction to engage a laboratory assistant, who would work under the chemists.

It was decided that the Director should advertise for a man who had passed the London Matriculation Examination or its equivalent. The commencing salary to be Rs. 1,500 per annum rising by annual increments of Rs. 120 per annum, up to Rs. 3,300 per annum, subject to an efficiency bar when the annual salary reached Rs. 2,100. The termination of the appointment to be subject to three months' notice.

Subordinate Staffs' Salaries.

The Chairman stated that the Director's letter No. 204 dated February 28th, 1928, had been circulated to the members of the Board, and the remark which had received the support of the majority of the other members was :—

"I consider motor car driver's annual increments on the proposed Government scale should be when he had completed two year's service with the Institute."

The Director was authorized :—

1. To engage a new clerk at a commencing salary of Rs. 100 per mensem, plus Nuwara Eliya allowance.

2. To place the car driver on Government scale of pay when he had completed 2 years' service with the Institute.

3. To pay the cooly at the rate of 80 cents per diem, i.e., Rs. 24 per mensem.

Mr. Jepson's Visit to America.

The Chairman announced that though the Board had agreed at its last meeting to pay part of Mr. F. P. Jepson's expenses if it became necessary to do so, he was pleased to announce that the Ceylon Legislative Council had sanctioned payment of the whole of the expenses by Government. He proposed that the Board should record their thanks to the Legislative Council; and also to the Director of Agriculture, who had been instrumental in obtaining the Council's sanction.—Carried.

Purchase of an Estate.

The CHAIRMAN stated that he had still nothing definite to report regarding the purchase of an estate. Since the last meeting neogotiations for the purchase of

an estate had proceeded so satisfactorily that he hoped before very long to be in a position to make a more satisfactory announcement.

Buildings and Laboratories.

The CHAIRMAN explained that the Buildings sub-Committee had met in the morning and had decided on the accommodation to be provided for the Institute's staff.

Lease of "Lindfield."

The CHAIRMAN reported that Col. Jayawardene had agreed to renew the lease of "Lindfield" for a further period of one year dating from the 1st July, 1928. The Board thanked Colonel Jayawardene for his action.

Annual Report.

The CHAIRMAN announced that the statements of accounts and the Secretary's portion in the annual report had been forwarded to Government in accordance with the Ordinance. The Director's portion of the report will be circulated amongst the Board.

In this connexion the Hon. Mr. Oldfield suggested that the Board should hold a special meeting for the purpose of adopting the annual report and accounts. He considered that such meeting should be open to the public and might be held in connexion with the Agricultural Conference in May.

It was decided to see if this could be done.

"Tea Quarterly"

Mr. KEILLER suggested that the Board should congratulate the Director on the first number of the Institute's Quarterly Journal. He considered that the journal contained very good matter and was well printed, but he agreed with the Chairman that the cover should be made of slightly stiffer material.

The Board approved of these suggestions.

Director's Report.

The Director read the following statement :—

The Mycologist has had under investigation two diseases of dadaps. One of these is the Dieback which has been attributed to Fusarium. The other is a root disease caused by Eelworm. The latter disease may be the reason why dadaps do not do well in certain areas. The disease is diagnosed by a gradual defoliation of the branches from the base upwards, and by the presence of large swellings on the roots. The Eelworm swellings may occur on the roots of dadaps which do not show any symptoms of defoliation, and hence it is possible that trees growing under favourable conditions may not suffer to any marked extent from the attacks of the parasite. Eelworm is a well-known parasite of Tea seedlings, and at least one case is known of a serious attack on old tea at a high elevation. We have, however, no evidence at present of a spread from affected dadaps to Tea.

Further observations have been made on the Armillaria root disease of tea, and two cases have been identified from another district.

In connexion with the healing of pruning wounds on tea, an interesting case has been observed, in which the wounds had callused over, but rot had continued down the branch after the callus had formed over the exposed wood. This points to the necessity of an antiseptic cover for wounds, even if the bush is sufficiently vigorous to heal them.

The Agricultural Chemist has visited estates to obtain soils on which it is reported tea will not grow, or is difficult to establish. These are now under examination. A scheme for the uniformity trial has been drawn up, and this is now being put in hand on two acres of tea which have been kindly lent for the purpose on Scrubs Estate.

The Bio-chemist has continued work on the aqueous extract of fresh and withered leaf, and has made preliminary experiments on the extraction of the sap from the leaf and the estimation of the sugars present in the leaf. Tests have been made of the method proposed by Carpenter for the determination of chemical wither, but these must be repeated in the low-country before any publication can be made.

The Entomologist investigated outbreaks of Nettle Grub in the Passara and Badulla districts and carried out some experiments in dusting with insecticides. Helopeltis was reported from the Morawak-Korale. Work has been continued on the egg parasite of Tea Tortrix, and a preliminary report on this was appended to the February report. It would appear that the breeding of the parasite in the eggs of

the grain moth is practicable under Ceylon conditions, but there are difficulties in breeding the grain moth continuosusly, at least at Nuwara Eliya. This work has necessarily limited the travelling of the Entomologist, as it requires continuous attention.

The Hon. Mr. Stockdale suggested that it would be advisable to commence parasite work at a lower elevation.

The Director was in agreement and suggested that the Entomologist should be sent to the Tortrix Area, i.e., Maskeliya, Dickoya or lower Dimbulla, for the purpose of breeding Tortrix parasites. This would mean erecting a small breeding house, training an Assistant and renting a bungalow for the Entomologist, who would probably have to live in the district for three months to start the experiments and afterwards pay periodical visits.

The unanimous opinion was that no time should be lost in making arrangements for this experiment being continued as indicated.

It was further decided that the Director should (a) submit an estimate of the cost of the experiment, (b) advertise for a bungalow in Maskeliya, Dickoya or lower Dimbula, (c) advertise for an Assistant.

Agricultural Chemist.

The following extract from a letter written by the Hon. Mr. Stockdale was read :—

"I would suggest that Mr. Eden be asked to concentrate at first upon those proposals which he has outlined under the heading soils, soil acidity and proposed field-work uniformity trials."

The Director stated in reply that he had been waiting until land was available for carrying out these tests and trials. He had now obtained permission to use 2 acres on Scrubs Estate, Nuwara Eliya, and work would be commenced when plucking re-started.

The Work of the Institute.

The Secretary was instructed to take steps to notify all superintendents of estates that all letters written to the Tea Research Institute should be addressed to the Director, not to individual officers.

The meeting closed with a vote of thanks to the Chair.

ANIMAL DISEASE RETURN FOR THE MONTH ENDED 30th APRIL, 1928.

Province, &c.	Disease	No. of Cases up to date since Jan. 1st, 1928	Fresh Cases	Recoveries	Deaths	Balance Ill	No. Shot
Western	Rinderpest	17	17	9	2	1	5
	Foot-and-mouth disease	386	22	312	1	69	...
	Anthrax	...	...	...	...	...	...
	Piroplasmosis	4	...	3	1	...	...
	Rabies (Dogs)	1	...	...	...	...	1
Colombo Municipality	Rinderpest	43	9	4	36	2	1
	Foot-and-mouth disease	252	8	243	9	...	...
	Anthrax	1	...	...	1	...	...
	Rabies (Dogs)	4	...	...	...	...	4
Cattle Quarantine Station	Rinderpest	42	9	10	21	11	...
	Foot-and-mouth disease	60	10	53	4	3	...
	Anthrax	...	...	...	...	...	...
Central	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	50	...	50	...	...	...
	Anthrax	...	...	...	...	...	...
	Rabies (Dogs)	2	...	...	...	...	2
Southern	Rinderpest	F R	E E				
	Foot-and-mouth disease						
	Surra						
Northern	Rinderpest	F R	E E				
	Foot-and-mouth disease						
	Piroplasmosis						
	Rabies (Dogs)						
Eastern	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	5	...	5	...	...	...
	Anthrax	...	...	...	...	...	...
	Piroplasmosis						
North-Western	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	225	11	222	3	...	...
	Anthrax	...	...	...	...	...	...
	Piroplasmosis						
	Rabies (Dogs)						
North-Central	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	298	...	297	...	1	...
	Anthrax	...	...	...	...	...	...
Uva	Rinderpest	...	...	...	...	...	...
	Foot-and mouth disease	10	2	10	...	...	...
	Anthrax	...	...	...	...	...	...
	Piroplasmosis						
	Rabies (Dogs)						
Sabaragamuwa	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	140	135	22	2	116	...
	Anthrax	...	...	...	...	...	...

MARTIN WIJAYANAYAKA,
For Government Veterinary Surgeon.

Colombo, 14th May, 1928.

METEOROLOGICAL

APRIL, 1928.

Station	Temperature: Mean Daily Shade	Temperature: Difference from Average	Mean Humidity	Mean amount of Cloud 0=clear 10=overcast	Mean Wind Direction During Month	Daily Mean Velocity	Rainfall: Amount	Rainfall: No. of Rainy Days	Rainfall: Difference from Average
	°	°	%			Miles	Inches		Inches
Colombo Observatory	81·6	−0·2	82	7·8	SW	95	8·98	19	+ 0·85
Puttalam	82·6	+0·4	80	3·6	SW	106	2·81	14	— 2·52
Mannar	85·4	+0·4	75	6·0	S	166	1·59	7	— 1·23
Jaffna	85·3	−0·5	74	5·2	S	185	2·45	3	+ 0·49
Trincomalee	83·8	−1·4	76	5·5	Var.	110	3·26	7	+ 1·30
Batticaloa	83·3	+0·1	78	5·2	Var	145	2·87	10	+ 1·00
Hambantota	81·8	−0·2	82	5·8	SW	232	5·32	11	+ 2·07
Galle	81·5	−0·3	84	5·8	WNW	148	8·20	17	— 1·50
Ratnapura	82·8	+0·4	78	6·8	—	—	15·86	24	+ 3·63
Anu'pura	82·8	−0·8	76	6·0	—	—	4·78	12	— 1·93
Kurunegala	82·3	−1·1	76	8·5	—	—	18·75	15	+ 9·26
Kandy	79·2	+0·2	74	6·0	—	—	13·29	20	+ 6·64
Badulla	74·6	−0·8	84	6·2	—	—	12·82	20	+ 5·54
Diyatalawa	68·6	−0·9	80	7·0	—	—	7·63	17	+ 2·04
Hakgala	64·6	−0·2	80	6·6	—	—	12·24	18	+ 5·23
N'Eliya	61·7	+1·3	78	7·6	—	—	7·23	17	+ 1·66

The total rainfall for April was decidedly above average, particularly in the southern half of the Island. Cases in which stations had more than ten inches above average were very common in the Central Province and not infrequent in Sabaragamuwa, Uva, and the Western Province.

The highest totals were Gikiyanakanda 27·50 inches and Udahena 25·50, and the biggest offsets above average Dooroomadella + 14·84 inches and Yarrow + 14·41.

North of a line from Puttalam to Kalmunai deficits were common, but by no means universal. In no case did a station fail to record any rain in the month.

As regards distribution in time, the first fortnight was very wet, the next week was much clearer, but heavy rain was recorded on the 23rd and the next few days. Falls of over 6 inches in a day were reported at Udahena (2nd), Delwita and Doragalla (10th,) Rayigam (11th) and Gikiyanakanda (25th).

On the whole the April thunderstorms were above average, a condition that has frequently been associated in the past with less than average rainfall over the south-west face of the hills during the ensuing period May-September.

A. J. BAMFORD,
Supdt., Observatory.

ANIMAL DISEASE RETURN FOR THE MONTH ENDED 31st MAY, 1928.

Province, &c.	Disease	No. of Cases up to date since Jan. 1st. 1927	Fresh Cases	Recoveries	Deaths	Balance Ill	No. Shot
Western	Rinderpest	55	18	4	26	...	5
	Foot-and-mouth disease	1,136	754	992	4	140	...
	Anthrax	...	...	...	...	...	...
	Piroplamosis	6	2	5	1	...	...
	Rabies. (Dogs).	1	...	...	...	...	1
Colombo Municipality	Rinderpest	101	58	4	80	16	1
	Foot-and-mouth disease	253	1	244	9	...	...
	Anthrax	1	...	...	1	...	...
	Rabies	4	...	...	...	..	4
Cattle Quarantine Station	Rinderpest	71	29	21	31	19	...
	Foot-and-mouth disease	68	8	58	4	6	...
	Anthrax	...	...	..	...	...	...
Central	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	77	27	55	...	22	...
	Anthrax	...	...	...	...	...	...
	Rabies (Dogs)	3	1	...	...	...	3
Southern	Rinderpest	F R E E					
	Foot-and-mouth disease						
	Anthrax						
Northern	Rinderpest	F R E E					
	Foot-and-mouth disease						
	Anthrax						
Eastern	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	116	111	116	...	...	...
	Anthrax	...	...	...	...	...	...
North-Western	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	718	493	458	3	257	...
	Anthrax	...	...	...	...	...	...
North-Central	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	298	...	298	...	...	...
	Anthrax	...	...	...	...	...	...
Uva	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	10	...	10	...	...	...
	Anthrax	...	...	...	...	...	...
Sabaragamuwa	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	847	707	589	18	240	—
	Anthrax	...	..	...	...	...	...

G. V. S. Office,
Colombo, 12th June, 1928.

G. W. STURGESS,
Government Veterinary Surgeon.

METEOROLOGICAL

MAY, 1928.

Station	Temperature: Mean Daily Shade	Temperature: Difference from Average	Mean Humidity	Mean amount of Cloud 0=clear 10=overcast	Mean Wind Direction during Month	Daily Mean Velocity	Rainfall: Amount	Rainfall: No. of Rainy Days	Rainfall: Difference from Average
	o	o	%			Miles	Inches		Inches
Colombo Observatory	82·8	+0·9	82	8·1	SW	125	7·92	26	— 5·92
Puttalam -	84·7	+2·0	78	5·1	SW	180	0·14	4	— 3·36
Mannar -	87·1	+1·7	73	4·5	SSW	229	1·32	1	— ·71
Jaffna -	85·3	+0·5	78	3·6	SW	363	0·00	0	— 1·72
Trincomalee -	86·1	+0·4	70	3·8	SW	193	0·45	2	— 2·04
Batticaloa -							0·14	1	— 1·64
Hambantota -	82·8	+0·6	82	4·6	SW	304	3·73	11	+ 0·53
Galle -	82·4	+0·6	84	7·0	W	194	7·50	24	— 4·06
Ratnapura -	83·2	+1·4	81	7·2	—	—	8·40	22	—10·02
Anu'pura -	84·4	+0·9	72	5·6	—	—	3·20	2	— 0·16
Kurunegala -	83·4	+0·6	76	7·8	—	—	2·11	15	— 4·59
Kandy -	80·4	+1·7	76	5·8	—	—	3·20	12	— 2·59
Badulla -	75·7	—0·3	83	9·8	—	—	4·73	10	+ 0·17
Diyatalawa -	70·4	—0·2	77	6·0	—	—	2·77	12	— 2·49
Hakgala -	66·3	+1·0	80	5·0	—	—	5·47	16	— 1·58
N.' Eliya -	63·2	+1·4	78	7·1	—	—	2·80	14	— 4·09

The rainfall of May was deficient over nearly the whole island. Deficits of more than ten inches below average were common in the Kelani Valley and adjacent areas and several stations were more than 15 inches behind. The number of days on which rain was recorded was however not so deficient as the amount of rain.

The only stations at which the average was reached were in the areas where the averages are comparatively low. Thus Liddesdale with a total of 11·01 inches beat its average by five inches and was the only station to do so.

The highest total for the month was 25·63 at Carney, which was however eight inches below its May average. This station also recorded the highest total for 24 hours viz. 8·88 on the 25th.

No rain at all was reported at most of the stations in the Jaffna Peninsula and at several in the N.W.P. and E.P.

Temperatures were fairly consistently above average. Wind velocity was on the whole slightly below average though at Jaffna it was markedly in excess.

A. J. BAMFORD,
Supdt. Observatory.